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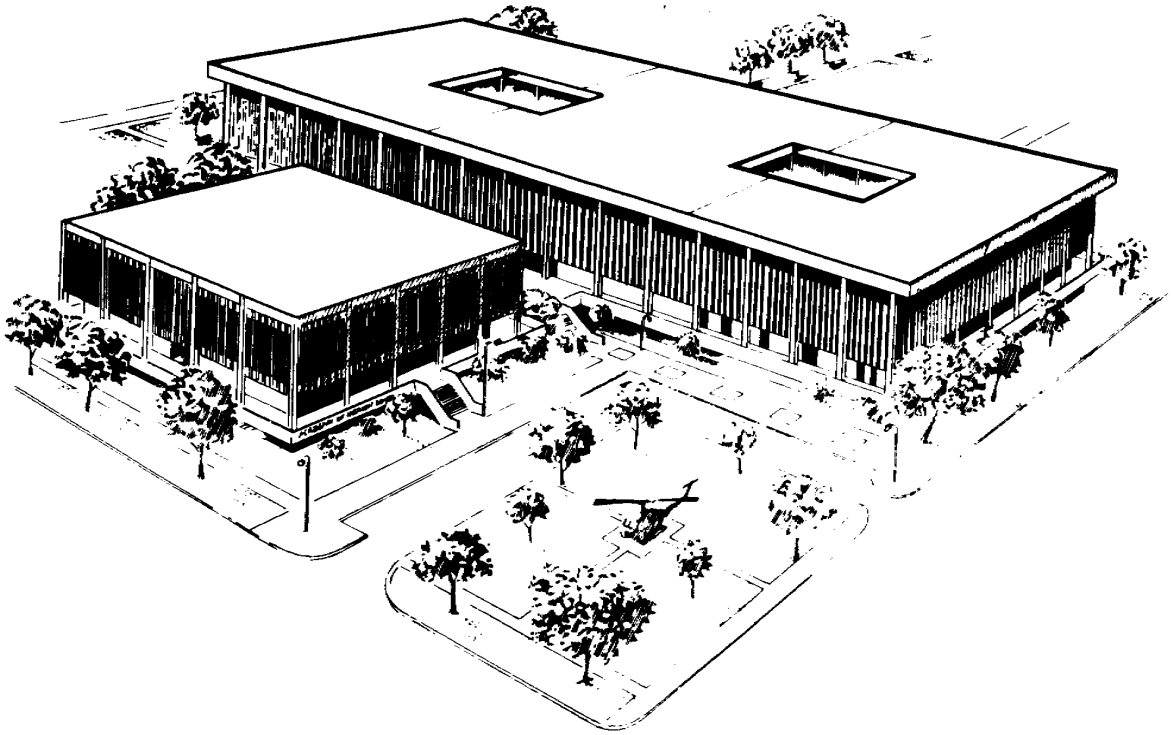
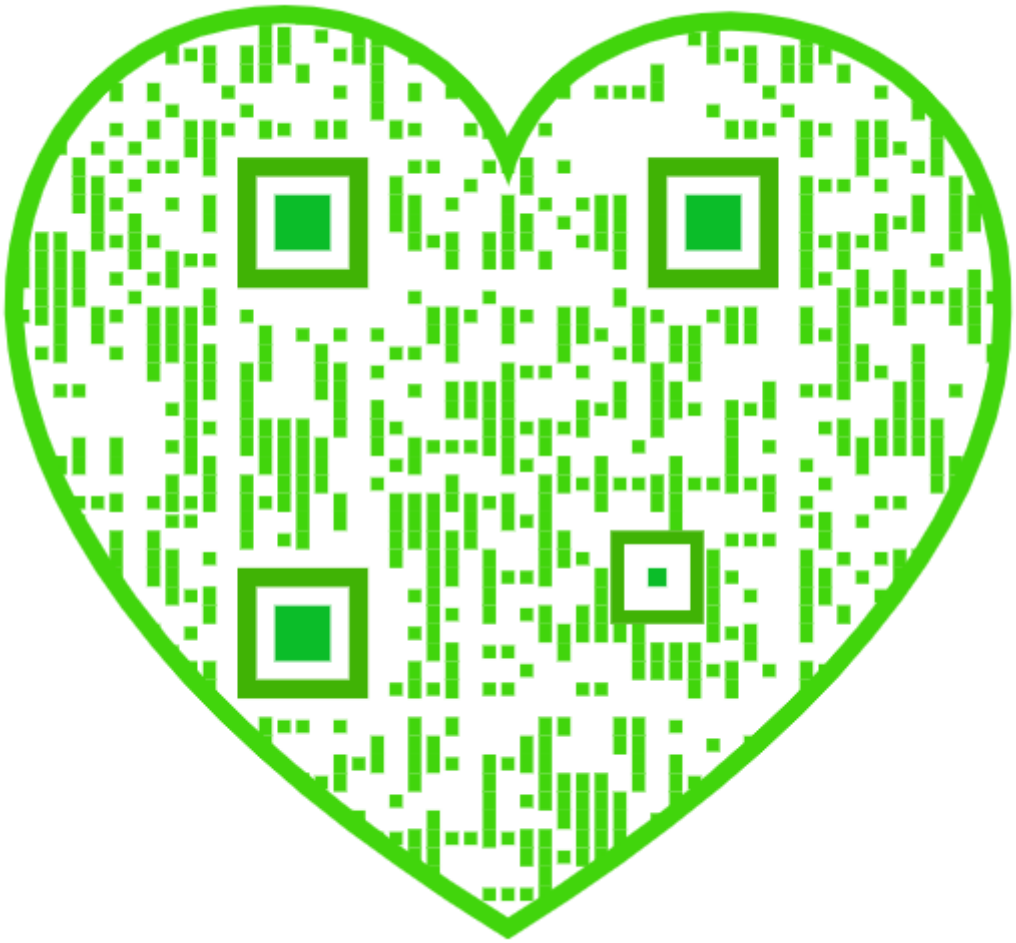


DENTAL ANATOMY AND PHYSIOLOGY

SUBCOURSE MD0501 EDITION 200



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When used in this publication, words such as "he," "him," "his," and "men" 'are intended to include both the masculine and feminine genders, unless specifically stated otherwise or when obvious in context.

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CORRESPONDENCE COURSE OF
THE ACADEMY OF HEALTH SCIENCES, U.S. ARMY

SUBCOURSE MED501

DENTAL ANATOMY AND PHYSIOLOGY

INTRODUCTION

In order for the Army to utilize its professional dental staff to the utmost, a carefully organized dental service system providing technical and administrative support for that professional staff is necessary. Dental specialists and other auxiliary personnel play very important roles in making this possible. A dental officer working with an efficient assistant can provide better and substantially more dental care than can one working alone. An additional significant increase in capabilities is shown among dental officers having the support of two or more auxiliary personnel.

The subcourses in the series for dental assistants and dental laboratory specialists are not designed to turn out completely trained personnel. This can be accomplished only in conjunction with close supervision in an on-the-job training status. The subcourses are designed to provide a review for personnel working in the dental area and provide basic fundamentals and techniques for personnel interested in the auxiliary dental fields.

This subcourse presents a general discussion of basic sciences related to the technical procedures in dentistry. It includes the principles of anatomy and physiology and dental anatomy.

Subcourse Components:

The subcourse instructional material consists of four lessons as follows:

Lesson 1, Introduction to Anatomy and Physiology.
Lesson 2, The Skull and Jaws.
Lesson 3, Topography of the Mouth and Tooth Structures.
Lesson 4, Dental Anatomy.

Here are some suggestions that may be helpful to you in completing this subcourse:

--Read and study each lesson carefully.

--Complete the subcourse lesson by lesson. After completing each lesson, work the exercises at the end of the lesson, marking your answers in this booklet.

--After completing each set of lesson exercises, compare your answers with those on the solution sheet that follows the exercises. If you have answered an exercise incorrectly, check the reference cited after the answer on the solution sheet to determine why your response was not the correct one.

Credit Awarded:

Upon successful completion of the examination for this subcourse, you will be awarded 15 credit hours.

To receive credit hours, you must be officially enrolled and complete an examination furnished by the Nonresident Instruction Branch at Fort Sam Houston, Texas.

You can enroll by going to the web site http://atrrs.army.mil and enrolling under "Self Development" (School Code 555).

A listing of correspondence courses and subcourses available through the Nonresident Instruction Section is found in Chapter 4 of DA Pamphlet 350-59, Army Correspondence Course Program Catalog. The DA PAM is available at the following website: http://www.usapa.army.mil/pdffiles/p350-59.pdf.

LESSON ASSIGNMENT

LESSON 1	Introduction to Anatomy and Physiology.
LESSON ASSIGNMENT	Paragraphs 1-1 through 1-14.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

1-1. Identify basic terminology related to human anatomy and physiology.

1-2. Identify the structure and function of the integumentary system.

1-3. Identify the structure and function of the skeletal system.

1-4. Identify the structure a d function of the muscular system.

1-5. Identify the structure and function of the circulatory system.

1-6. Identify the structure and function of the digestive system.

1-7. Identify the structure and function of the nervous system.

1-8. Identify the structure and function of the urogenital system.

1-9. Identify the structure and function of the endocrine system.

SUGGESTION After studying the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 1

INTRODUCTION TO ANATOMY AND PHYSIOLOGY

1-1. GENERAL

Anatomy is the study of the structure of the body, its organs, and the relationship of its parts. There are many subdivisions or branches of this science. Physiology is the study of the functions and activities of the parts of the body. This science also has many subdivisions. In this lesson, both anatomy and physiology are presented in the discussion of the structure and function of the various systems of the human body. These systems are closely interrelated and interdependent.

1-2. CELLS

The cell is the basic functioning unit in the composition of the human body and all other living organisms. It is microscopic in size. The body is composed of billions of cells that vary in size and shape. A simple cell includes the cell membrane or cell wall, nucleus, and cytoplasm (see figure 1-1). In addition to these parts, cells include many other smaller parts.

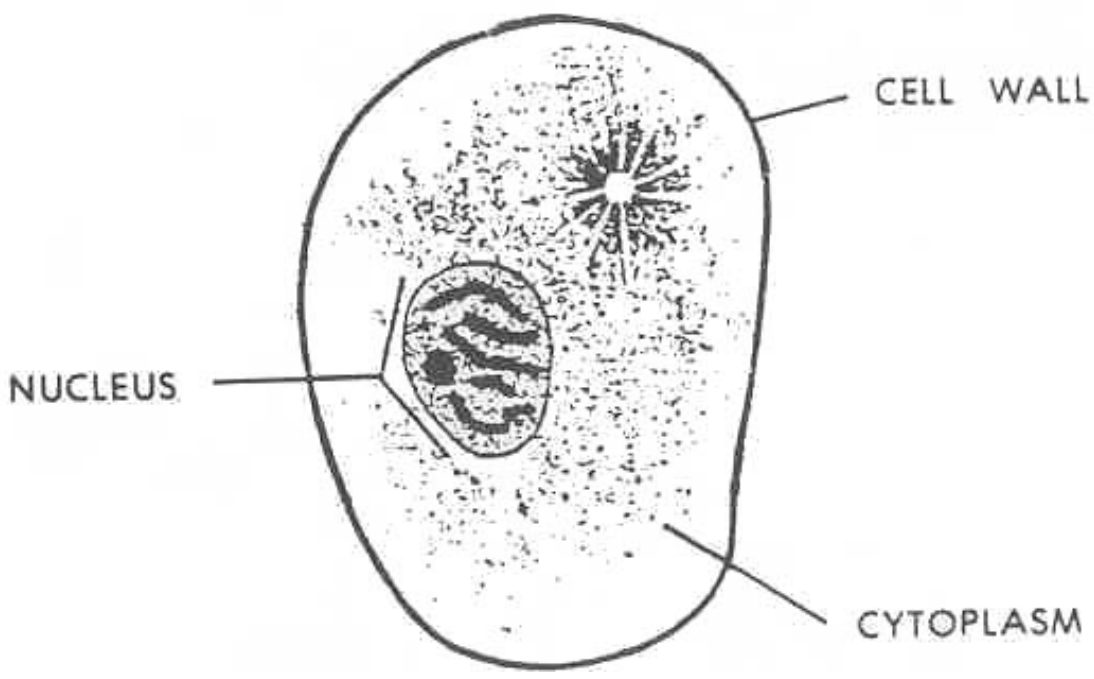

Figure 1-1. Simple cell.

a. **Cell Membrane.** This membrane surrounds and separates the cell from its environment. It encloses the cytoplasm. The cell membrane also allows certain materials to pass through it as they enter or leave the cell. It is through the cell membrane that all materials essential to metabolism are received. All products of metabolism are disposed of through the cell membrane. The bloodstream and tissue fluid circulate around the cells and transport the materials to and from these cells.

b. **Nucleus.** This controls all activities of the cell, including growth and reproduction. Information is stored in the nucleus and distributed to guide the life processes of the cell. Cells reproduce to replace worn-out cells, to build new tissues, and to bring about the growth of the body.

c. **Cytoplasm.** This is a semifluid material found inside the cell, but outside the nucleus. Cytoplasm is enclosed by the cell membrane. It is responsible for most of the chemical activities of the cell.

1-3. TISSUES

A tissue is a group of similarly-specialized cells working together to perform a particular function. The four main types of tissues are epithelial, connective, muscle, and nerve.

a. **Epithelial.** Epithelial tissue covers inner and outer surface of the body. It serves as a lining for vessels and other small cavities inside the body and as skin outside the body.

b. **Connective.** Connective tissues are distributed throughout the body to hold tissues together, to support other tissues, and to fill spaces.

c. **Muscle.** There are three specialized types of muscular tissue found in the body--striated (arms and legs), smooth (blood vessels), and cardiac (heart). Muscular tissue has the ability to contract (shorten), thus producing movement.

d. **Nerve.** Nerve tissue receives and transmits electrical impulses (messages).

1-4. ORGANS

An organ is a structure that is a somewhat independent part of the body and is composed of several different tissues. Each organ performs a specialized function or functions. The body has many organs.

1-5. SYSTEMS

The organs of the body are arranged into nine major systems. Each system has a specific function to perform. All systems are interdependent.

1-6. INTEGUMENTARY SYSTEM

The integumentary system includes the skin, a double-layered structure covering the surface of the body, and accessory organs such as glands, hair, and nails (see figure 1-2). The skin is the largest organ of the body. It functions to protect inner tissues from drying (desiccation) and underlying structures from infection and injury. Although absorption is not one of its normal functions, the skin can absorb water and other substances. The skin contains sensory receptors for heat, cold, touch, and pain. Skin also helps in the regulation of body temperature and limited excretion of wastes.

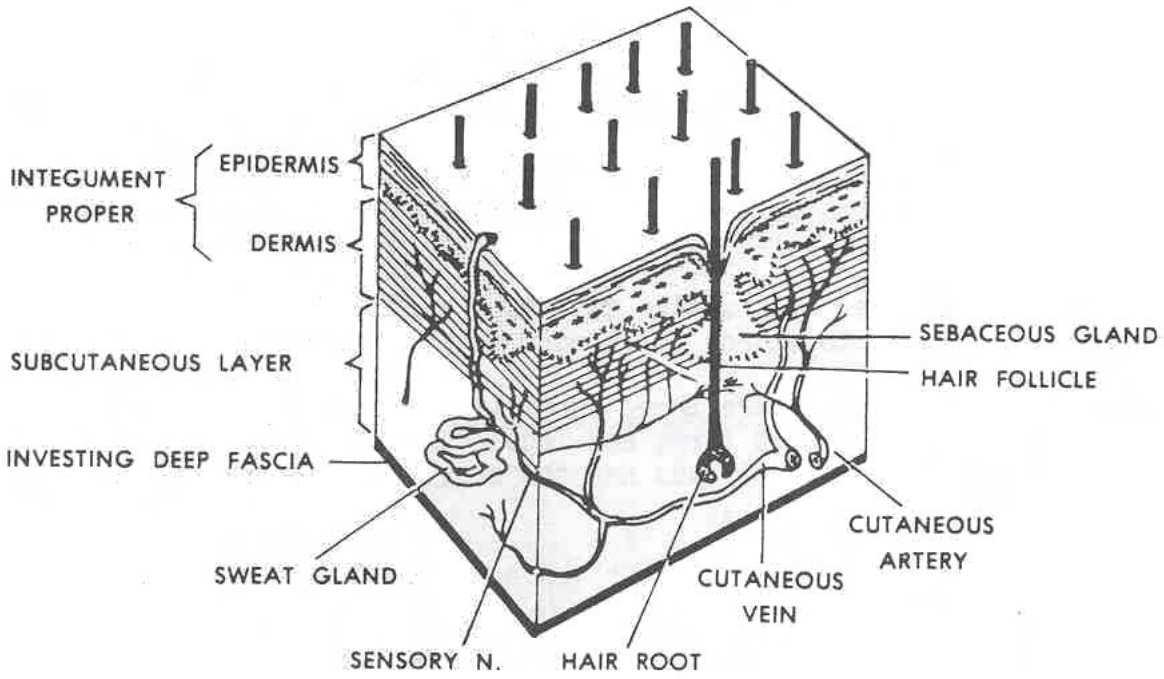

Figure 1-2. Cross section of the skin.

1-7. SKELETAL SYSTEM

The adult human skeleton includes 206 bones (see figure 1-3). Bones consist of a hard outer shell (cortex) and a spongy or porous inner part (spongiosa). Within some bones there is a cavity which contains marrow. Marrow is a soft tissue composed chiefly of fat and blood-forming tissue (see figure 1-4). Some bones form movable joints and, with the action of muscles, these joints bring about movement of the body and its parts. Other bones, such as those of the skull, are joined in a fixed position. The functions of the skeletal system are to

a. Support and give shape to the body.

b. Protect certain vital organs.

c. Provide attachment for tendons, muscles, and ligaments.

d. Serve as joint levers by which movements may be accomplished when acted upon by muscles.

e. Serve as a connective tissue in which calcium and other mineral salts are deposited.

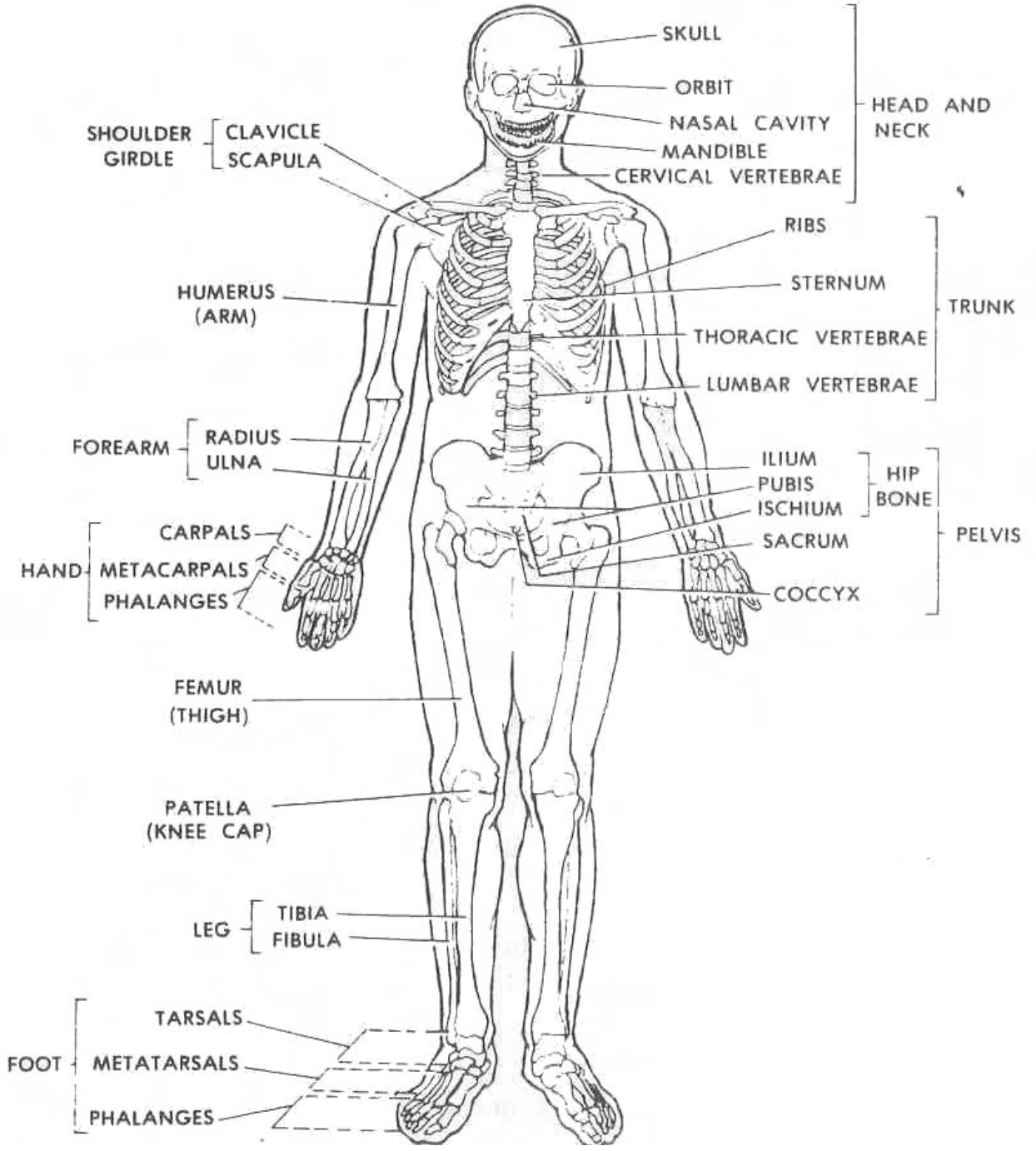

Figure 1-3. Skeleton, anterior view.

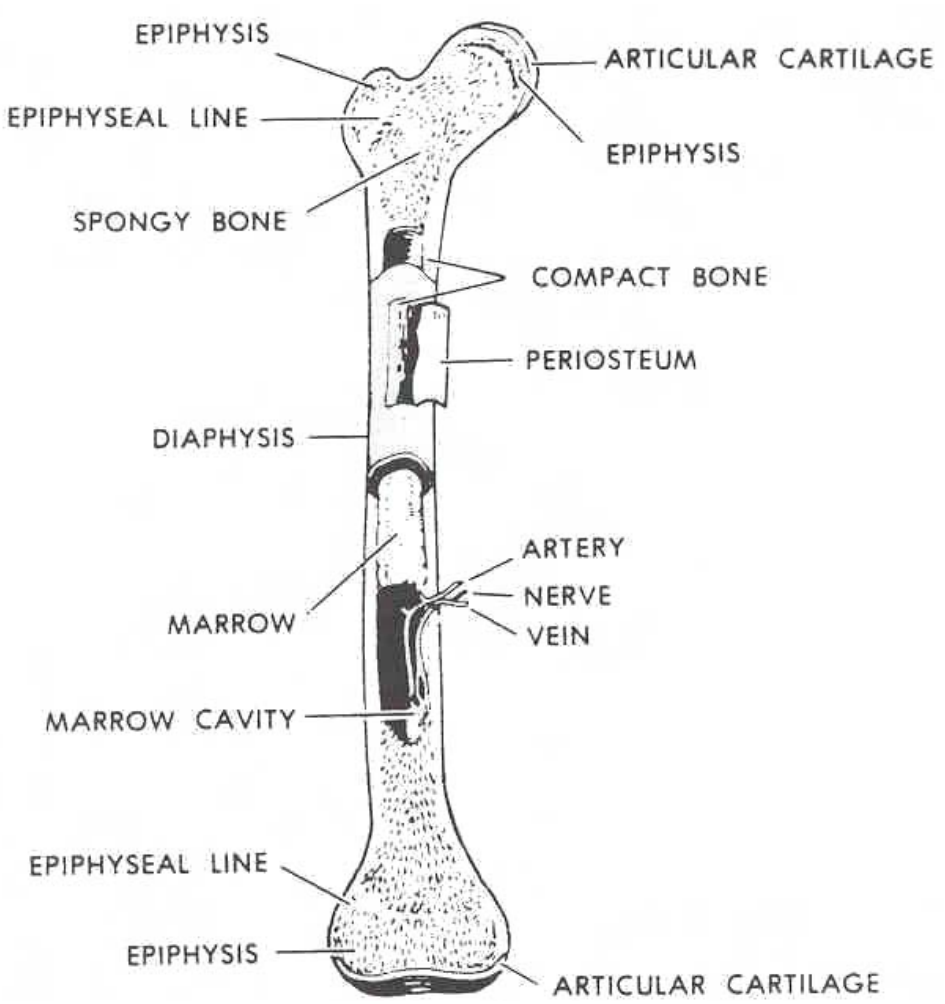

Figure 1-4. Diagram of a bone.

1-8. MUSCULAR SYSTEM.

This system includes over 350 muscles. These muscles are made up of muscle tissue. They constitute 40 to 50 percent of the body's weight. The muscular system moves and propels the body and the contents of the hollow organs. It also keeps the body erect and produces body heat. Three types of muscles are found in the body.

a. **Striated Muscle.** This muscle produces bodily movement. Skeletal muscle is also called voluntary muscle since it can be consciously controlled. Figures 1-5 and 1-6 illustrate some skeletal muscles.

b. **Smooth Muscle.** This muscle is found in various visceral organs where continuous automatic functions are necessary. Smooth muscle is also called involuntary muscle since it contracts without conscious direction by the individual. For example, the unconscious contraction of the intestinal muscle moves food through the digestive system.

c. **Cardiac Muscle.** This muscle is a specialized type of involuntary muscle. It is found in the muscular wall of the heart.

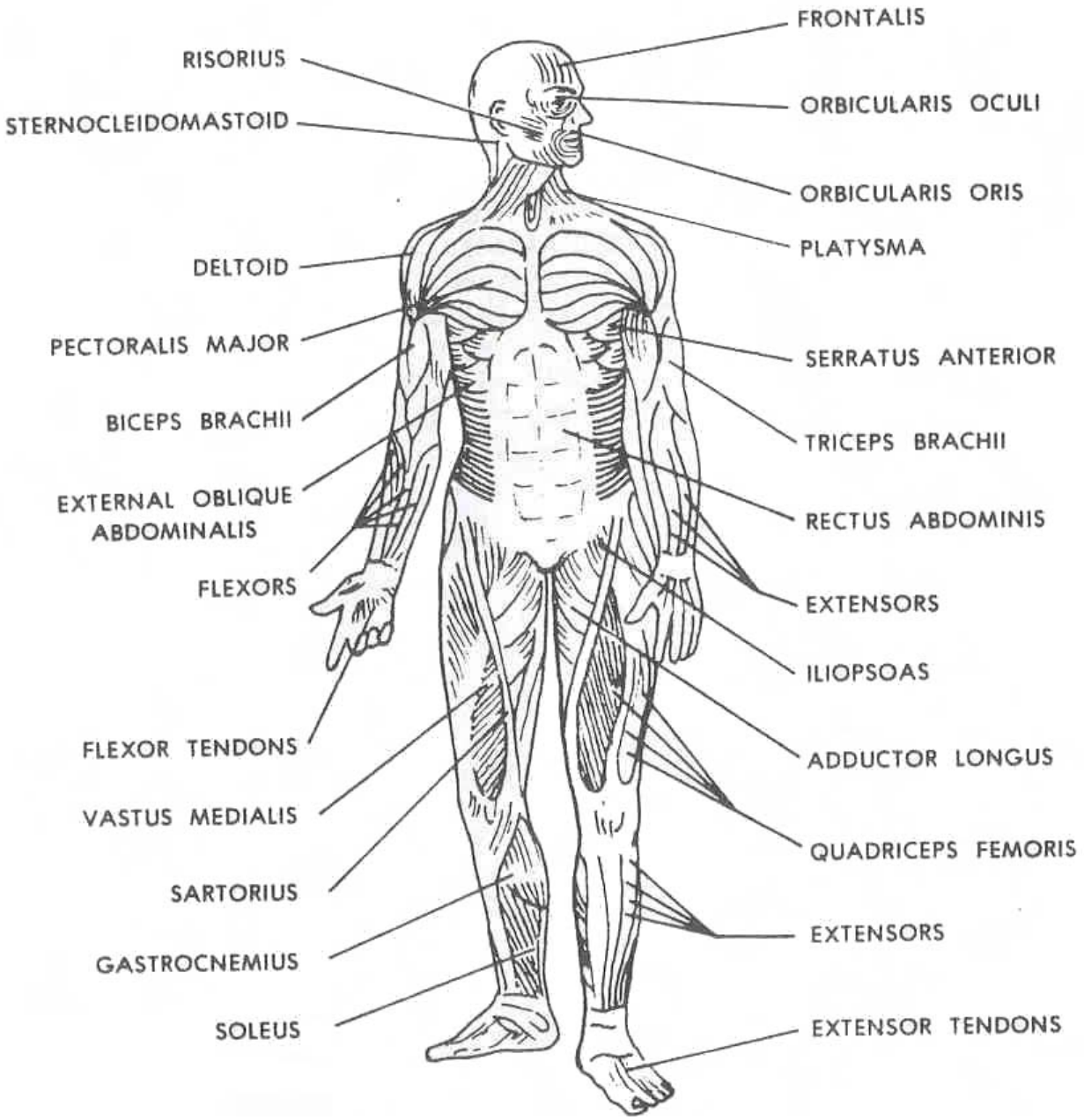

Figure 1-5. Skeletal and facial muscles, anterior view.

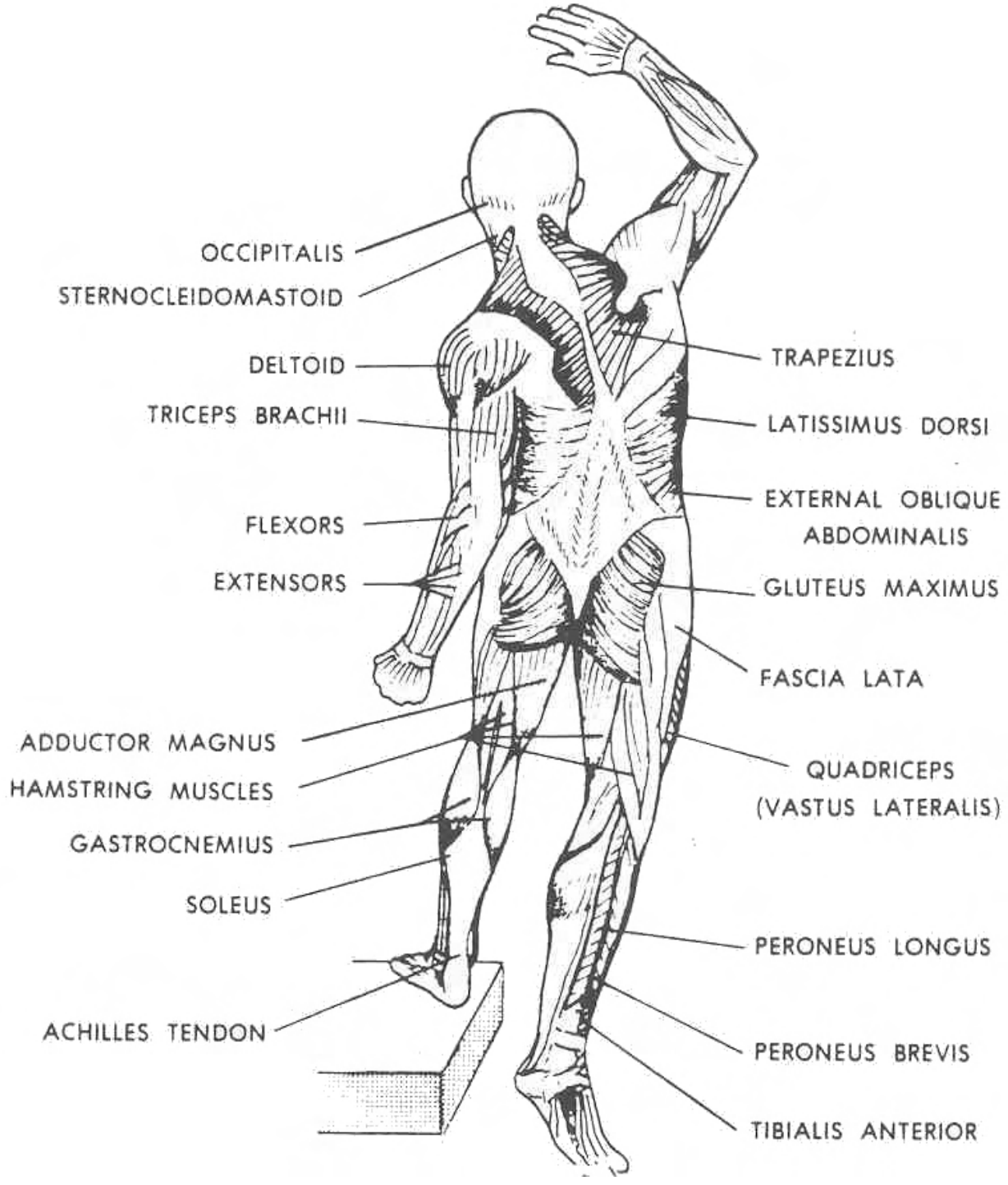

Figure 1-6. Skeletal and facial muscles, posterior view.

1-9. CIRCULATORY SYSTEM

The circulatory system includes the heart, blood, blood vessels (arteries, capillaries, and veins), and lymphatics. The function of the circulatory system is to circulate blood to the tissues of the body. These tissues supply oxygen and nutrients to the cells and remove carbon dioxide and other wastes.

a. **Heart.** The heart is a muscular, cone-shaped organ (see figure 1-7). It continuously pumps blood to all parts of the body. It is divided into two separate halves, each forming a pump. Each half is divided into an upper chamber (atrium) and a lower chamber (ventricle) by a valved partition. The valves in these partitions allow blood to flow in only one direction (into the ventricle). The right atrium receives deoxygenated blood from the body tissues, which is then transferred to the right ventricle. The right ventricle pumps the deoxygenated blood to the lungs where the blood is oxygenated. From the lungs, the blood returns to the left atrium, goes to the left ventricle, and is finally pumped again out into the arteries. The heart beats in a cycle (called the cardiac cycle), never stopping this regular rhythmic beat. This cycle consists of alternate contractions and dilations of the heart. The phase in which the heart contracts is called systole. The phase in which it dilates is called diastole.

(1) Systole. Systole starts with a simultaneous contraction of both atria. This is followed by a simultaneous contraction of both ventricles. As ventricular contraction starts, the atrioventricular valves close. At the end of the ventricular contraction, the valves close between the ventricles and the large arteries into which the blood was pumped.

(2) Diastole. Diastole starts after the closing of the valves. During diastole, the heart muscle of all chambers relaxes while blood flows into the atria. When the atria are filled, the atrioventricular valves open, the atria contract, and the cycle starts again.

(3) Heartbeat. Normally, the heart contracts 70 to 80 times a minute. This varies depending on such factors as age, sex, physical fitness, and emotional state of the individual. The heartbeat causes a wavelike expansion of the arteries called pulse. The pulse may be felt and counted at points where arteries are close to the surface of the body, such as the inner surface of the wrist.

b. **Blood.** Blood has many important functions besides the oxygen/carbon dioxide exchange between lungs and cells. Blood carries food absorbed from the digestive tract to the cells. It also carries wastes of cell metabolism to the excretory organs for elimination from the body. Other functions of the blood include the circulating of chemical substances (hormones) secreted by endocrine glands, helping to maintain body temperature, protecting the body against infection, and keeping the proper balance between chemicals in the body. There are about 11 to 12 pints of blood in the average adult body. The blood is composed of plasma, red blood cells, white blood cells, and platelets. See figure 1-8 for a simplified diagram of blood circulation.

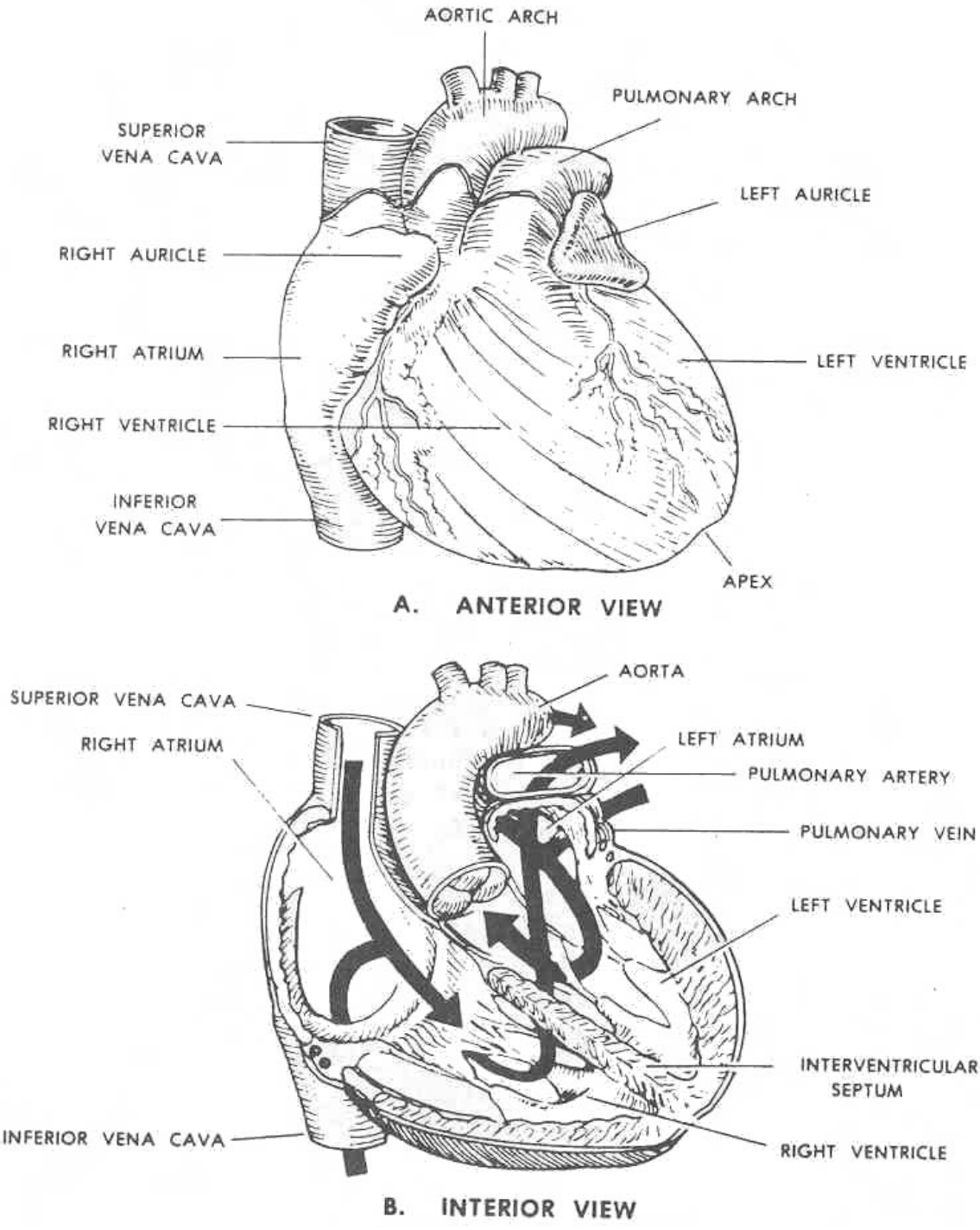

Figure 1-7. Heart

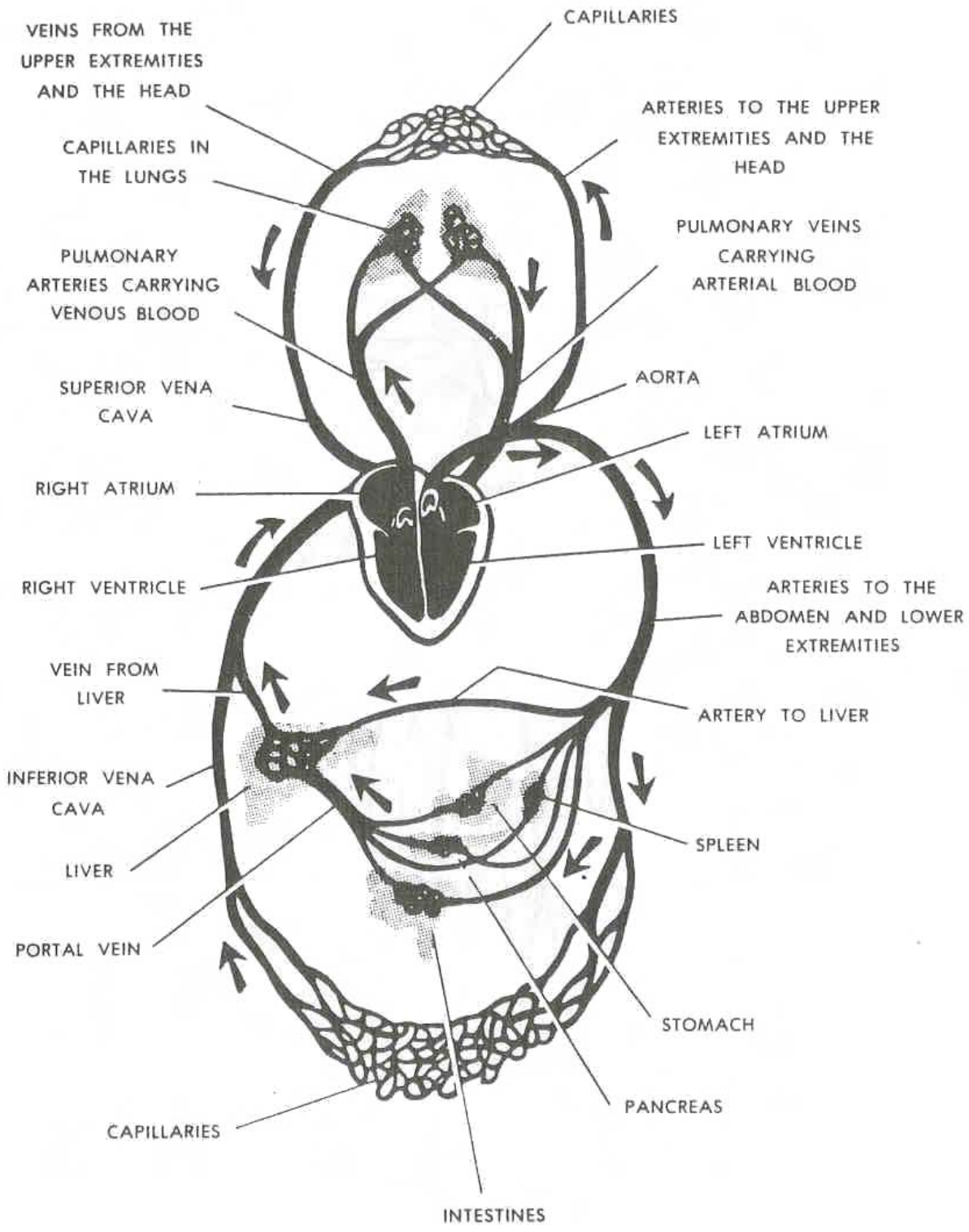

Figure 1-8. Circulation of the blood.

(1) Plasma. Plasma is a protein-containing fluid which constitutes 50 to 60 percent of the blood by weight. Plasma is the liquid medium that carries food to the cells and waste products away from the cells.

(2) Other blood components. Red blood cells (erythrocytes), white blood cells (leukocytes), and platelets (thrombocytes) are carried through the circulatory system suspended in plasma. Red blood cells, white blood cells, and platelets constitute 40 to 50 percent of blood by weight. Red blood cells are disk-shaped, cell-like bodies without a nucleus. They contain a substance called hemoglobin. Hemoglobin combines with oxygen to carry it from the lungs to the tissues. Oxygenated hemoglobin is red and gives blood its color. White blood cells are colorless, vary in size and shape, and have a nucleus. They protect the body by destroying foreign substances, such as bacteria, in the blood and tissues. White blood cells move about by a "flowing" motion. They squeeze through capillary walls and move through tissues in pursuit of bacteria. Platelets are smaller than red blood cells. They are round or oval in shape without a nucleus. Platelets aid in the clotting of blood at wound sites. In an average person, each cubic millimeter of blood contains about 5,000,000 red blood cells, 5,000 to 10,000 white blood cells, and 300,000 platelets.

c. **Blood Vessels.**

(1) Arteries. Blood pumped by the heart is carried to the tissues through a system of elastic, hollow tubes called arteries (see figure 1-9). This system of arteries is like a tree with a large trunk. The arteries leave the heart and give off branches which repeatedly divide and become smaller and smaller. The arteries have a nerve supply controlled by the autonomic nervous system allowing them to enlarge or constrict.

(2) Capillaries. The arteries branch into billions of tiny vessels called capillaries. The capillaries have very thin walls through which food and oxygen pass from the blood to the cells. While food and oxygen are passing through the walls of the capillaries, another process is going on. This process causes the waste materials and carbon dioxide from the cells to pass back into the capillaries. Thus, the capillaries make the necessary exchanges of water, gases, salts, food, and wastes between the blood and the tissues.

(3) Veins. As carbon dioxide and waste materials enter the capillaries and as the blood loses oxygen and food, it turns from a bright red to a darker red. Here the venous system begins. The vessels, now called veins, are no longer elastic and muscular. Their walls are thin and collapsible. Veins have paired valves to prevent the backflow of blood. Veins, like arteries, resemble a tree with many branches and eventually form major trunks leading back to the heart (see figure 1-10). The supply of blood to any part of the body may be increased or decreased by a change in the rate of heartbeat or in the size of blood vessels.

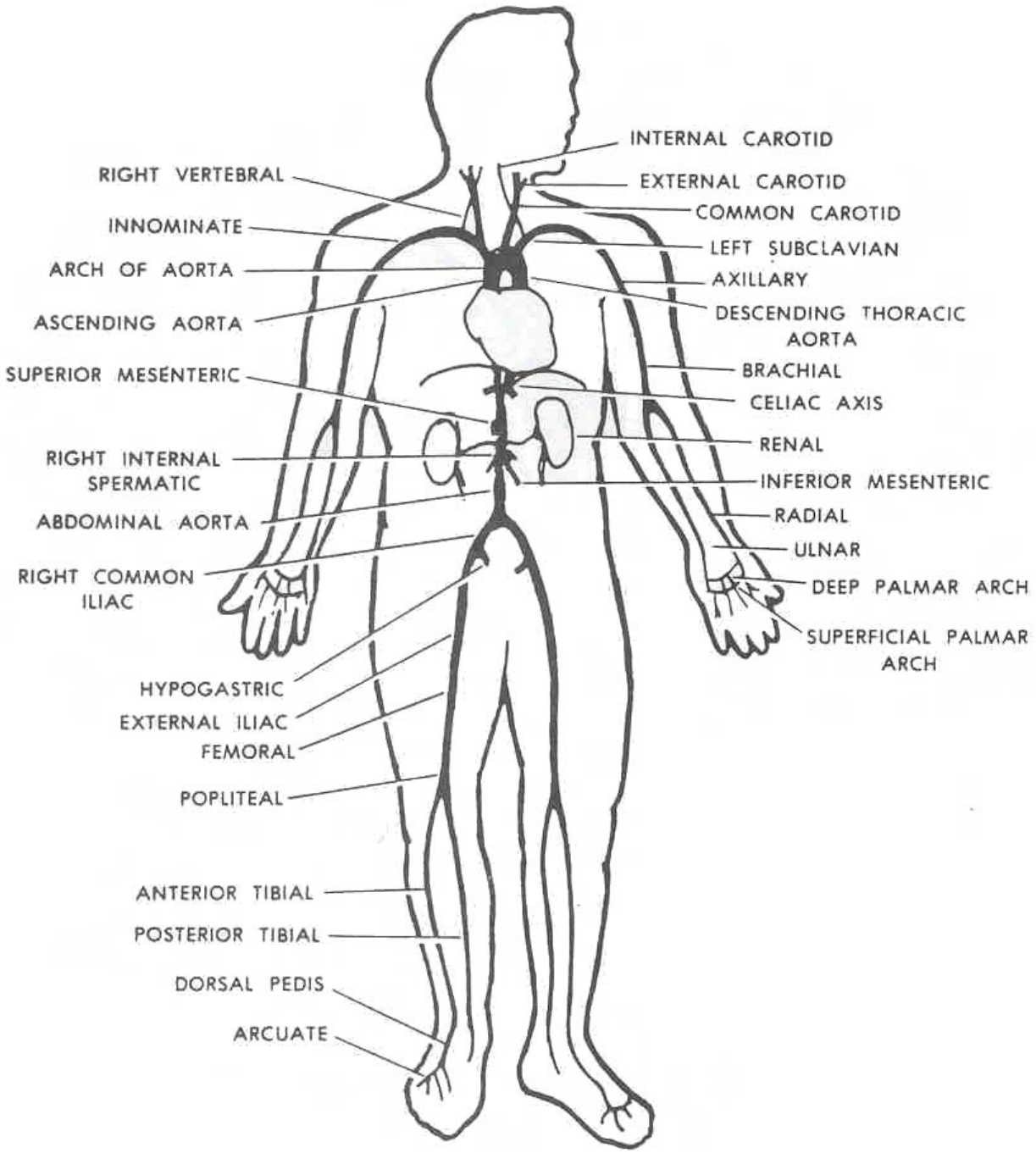

Figure 1-9. Major arteries of the body.

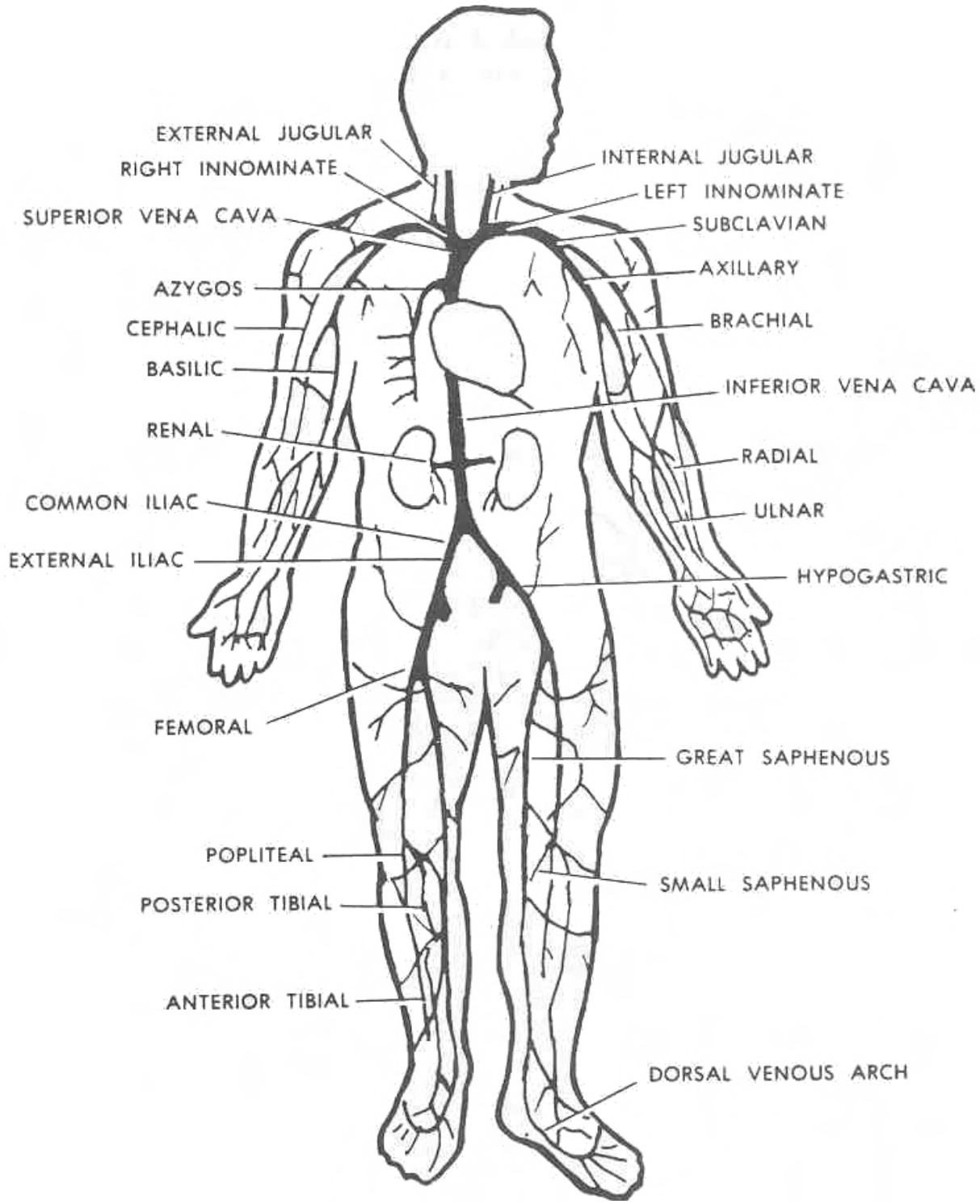

Figure 1-10. Major veins of the body.

d. **Lymphatics.** The lymphatic system consists of lymph, lymphatic vessels, and lymph nodes (see figure 1-11). Structures and glands characterized by the presence of lymphocytic cells--spleen, tonsils, thymus, and lymphatic nodules of the intestine (Peyer's patches)--are also part of the lymphatic system. Lymph drains through its own system of lymphatic vessels (lymphatics) into the jugulo-subclavian venous region of the neck and thus back to the heart. Along the course of the lymphatics are structures called lymph nodes. Lymph nodes are filters removing infectious materials from the lymph stream. They are also the main source of certain white blood cells. Examples of lymph nodes are the axillary nodes and the submaxillary nodes.

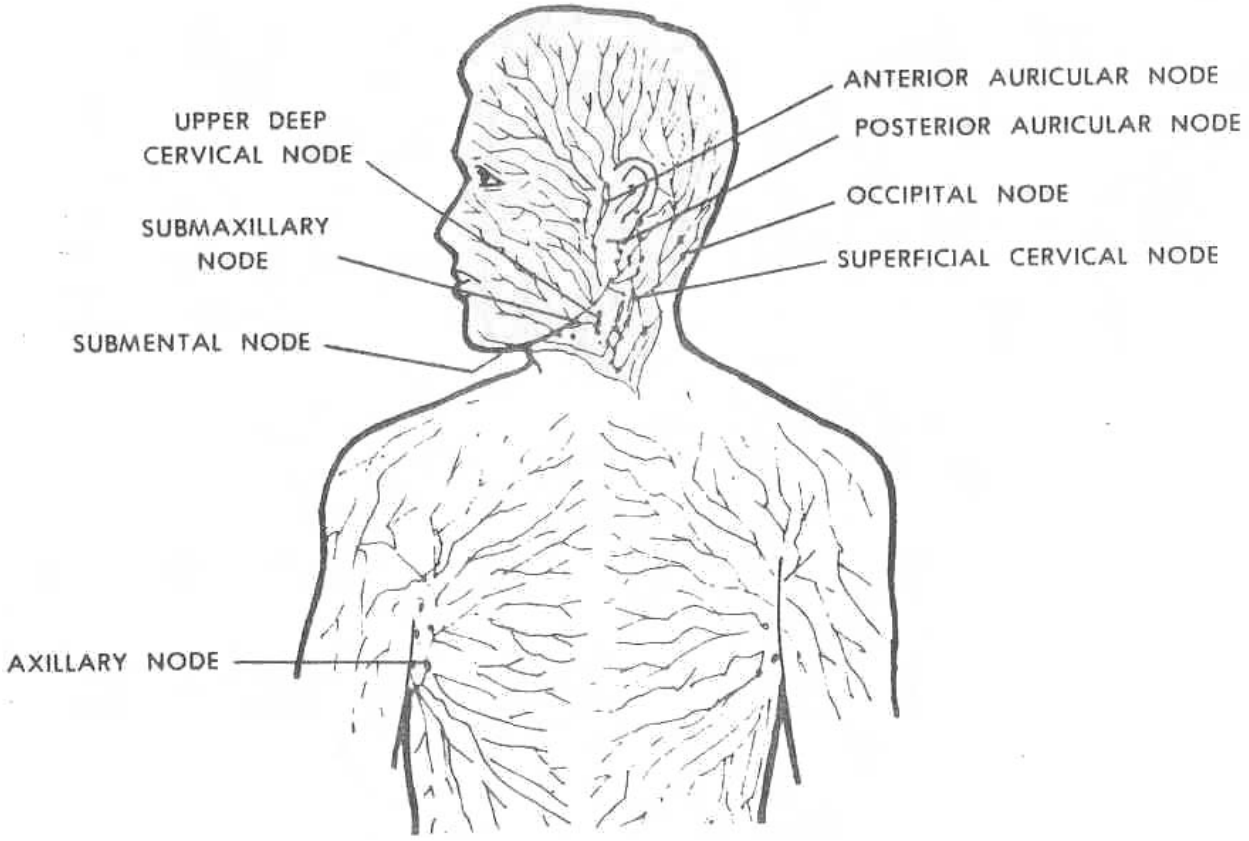

Figure 1-11. Lymphatic system.

1-10. DIGESTIVE SYSTEM

This system consists of the alimentary tract and certain accessory organs (see figure 1-12). The alimentary tract is a specialized tube extending from the mouth to the anus. The alimentary tract is divided into the mouth, pharynx, esophagus, stomach, small intestine, large intestine, rectum, and anus. The accessory organs are the salivary glands, pancreas, liver, gallbladder, and intestinal glands. The digestive process begins with the intake of food. The complex chemical substances of food are then broken down into simple chemical substances (food products). Food products pass through the intestinal wall into the bloodstream to be used by the cells. During the digestive process, specific digestive actions take place in the different parts of the alimentary tract.

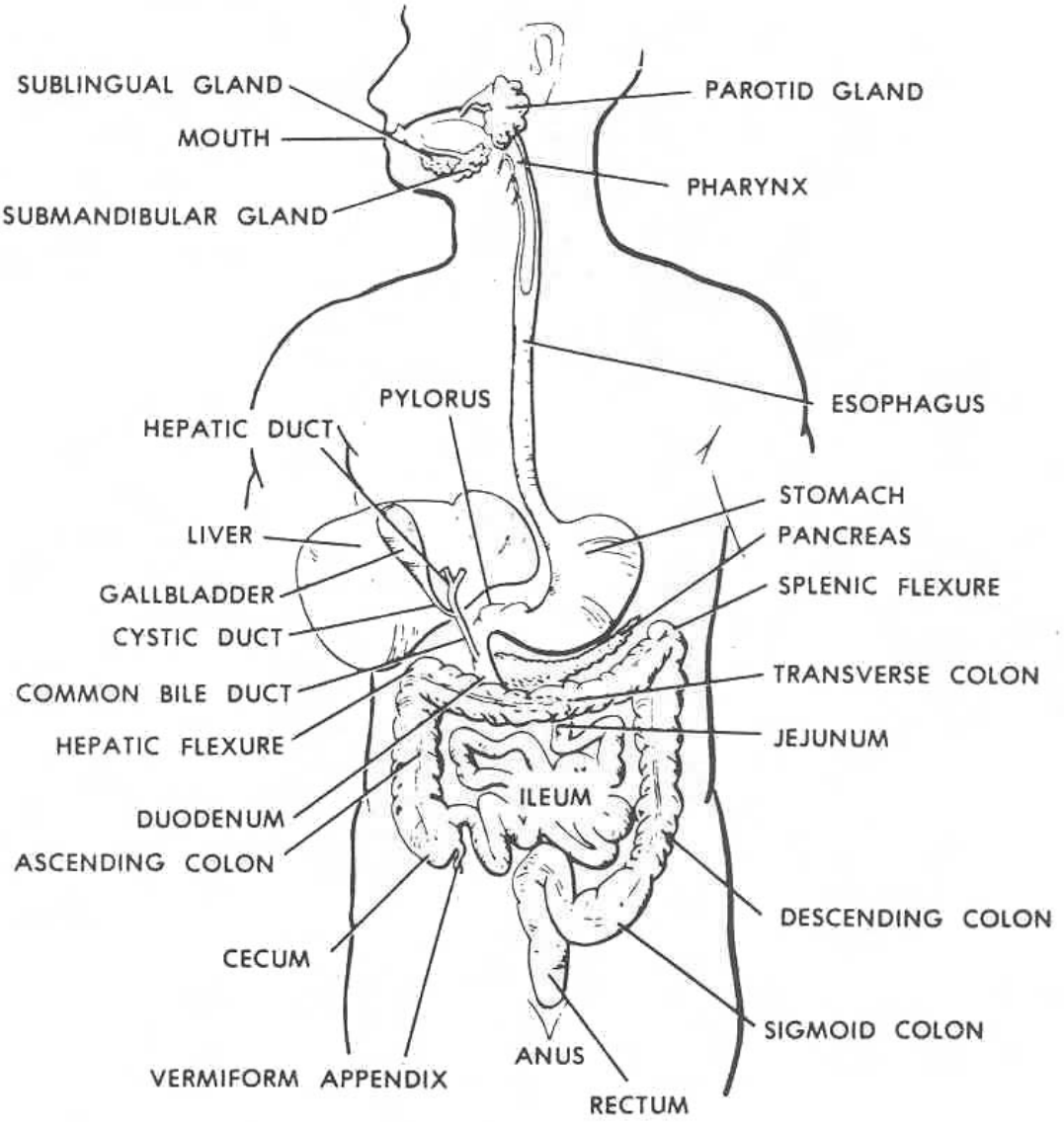

Figure 1-12. Digestive system.

a. **Mouth.** In the mouth, food is ground into small particles by the teeth. Food is moistened and softened by saliva. Saliva is secreted by the salivary glands. This action of the teeth and saliva prepares the food so it can be easily swallowed. An enzyme in the saliva (ptyalin) starts the chemical breakdown of starchy foods.

b. **Pharynx.** The pharynx is a muscular tube forming a passage from the mouth to the esophagus. When swallowing occurs, the tongue pushes the food to the back of the mouth. The food passes through the pharynx to the esophagus. The pharynx connects with both the mouth and nose. Air passes from the nose, through the pharynx, to the larynx, and to the trachea (windpipe). When food is being swallowed, a lid-like structure (the epiglottis) closes off the larynx so food will not enter.

c. **Esophagus.** The esophagus is also a muscular tube. It extends from the pharynx through the thorax to the upper end of the stomach. The chewed food is passed through the esophagus by a wavelike motion of its muscular walls. This motion, called peristalsis, is also found in the intestines.

d. **Stomach.** The stomach is a muscular, bag-like organ. It is located in the upper left part of the abdomen. At its upper end, the stomach connects with the esophagus. At its lower end, the stomach connects with the small intestine. The stomach secretes several enzymes and an acid which aid in the chemical breakdown of carbohydrates, proteins, and fats. The churning action of the stomach's wall, the action of the enzymes, and the action of the acid reduce the food to a semifluid mass called chyme. The stomach does not empty this mass all at once. At intervals, it squirts chyme into the small intestine. By the time chyme leaves the stomach, the food is about half digested.

e. **Small Intestine.** The small intestine is a muscular tube about 21 feet in length and 1 inch in diameter. It has many folds and curves and occupies a large part of the abdomen. Here, the final phase of digestion is completed. In this phase, enzymes secreted from the pancreas, liver, and walls of the intestine itself mix with the food as it enters the small intestine and act upon the food as it passes through the intestine by peristaltic action. When digestion is completed, the digested end products are absorbed through the wall of the small intestine and into the bloodstream. Certain ingredients of food are not digested. They cannot be broken down into an absorbable form by the digestive process. This undigested food passes through the small intestine into the large intestine.

f. **Large Intestine.** The large intestine, continuous with the small intestine, is about 5 feet in length and 2 inches in diameter. It is called the large intestine because its diameter is approximately twice that of the small intestine. The main function of the large intestine is the recovery of water. Undigested food, bacteria in the intestine and secretions from the digestive tract enter the large intestine in a semifluid form. During the passage of this material through the large intestine, water is absorbed through the intestinal wall. The remaining solid material is packed or squeezed into a form called feces. The feces then pass through the rectum.

g. **Rectum and Anus.** The rectum, continuous with the large intestine, is about 6 inches in length. It receives feces from the large intestine and periodically expels it through the anus. The anus is the external opening at the end of the digestive tract.

1-11. NERVOUS SYSTEM

This system includes a group of organs which controls and integrates the intellectual and physical processes of the individual. The nervous system is made up of nerve tissues. The main structure of the conductive nerve tissues is the neuron, a specialized cell designed to conduct electrical impulses. The nervous system is divided into the central nervous system, the peripheral nervous system, and the autonomic nervous system.

a. **Central Nervous System.** The central nervous system includes the brain and the spinal cord (see figure 1-13). The brain, located within the cranium, is the control center of the body. Within the brain, specific areas control specific body functions. For example, there are control centers for speech, sight, hearing, movement, heartbeat, breathing rate, and body temperature. The spinal cord is a reflex control center. It is composed of countless nerve fibers. These nerve fibers go down from and go up to the brain. The spinal cord is enclosed in the spinal column (backbone) for protection. The nerves of the peripheral and autonomic nervous systems have their roots in the central nervous system,

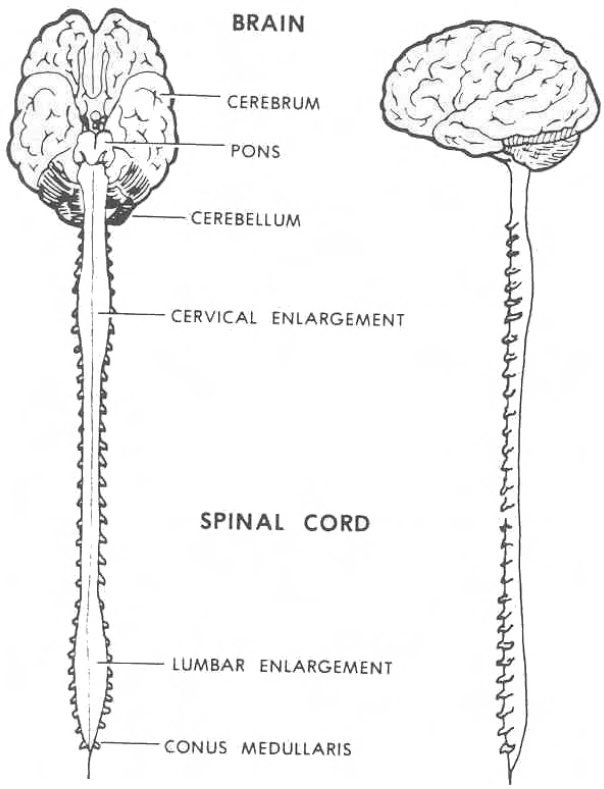

Figure 1-13. Central nervous system.

b. **Peripheral Nervous System.**

(1) Structure. The peripheral nervous system consists of the cranial and spinal nerves and their branches (see figure 1-14). Twelve pairs of cranial nerves have their roots in the brain. These nerves give off branches to the structures of the head and face. Thirty-one pairs of spinal nerves have their roots in the spinal cord. They give off branches to the structures of the body from the neck down. Each nerve supplies a specific body area or structure (called innervations). Because many of the various nerve branches join together (anastomose), the result is an overlapping of nerve supply to certain parts. Even though some peripheral nerves are composed entirely of either motor fibers or sensory fibers, most contain both.

(2) Function. The peripheral nervous system primarily involves conscious activity of the body. The sensory nerves carry impulses (such as touch, pain, and sight) to the brain. The brain normally evaluates the impulse and sends out, through motor nerves, impulses which cause a bodily response. Normally, all conscious body movements result from interaction of the peripheral and central nervous systems. However, there is an exception called a reflex action. Reflex action results when some sensation or stimulation passes over a reflex arc to a peripheral organ. The organ is thus stimulated to act without the aid of consciousness. For example, jerking your hand away from a hot stove that you accidentally touched.

c. **Autonomic Nervous System.** This system controls the action of cardiac and smooth muscles, sweat glands, digestive glands, some endocrine glands, and dilation and contraction of blood vessels. The control of this system is almost entirely involuntary and subconscious.

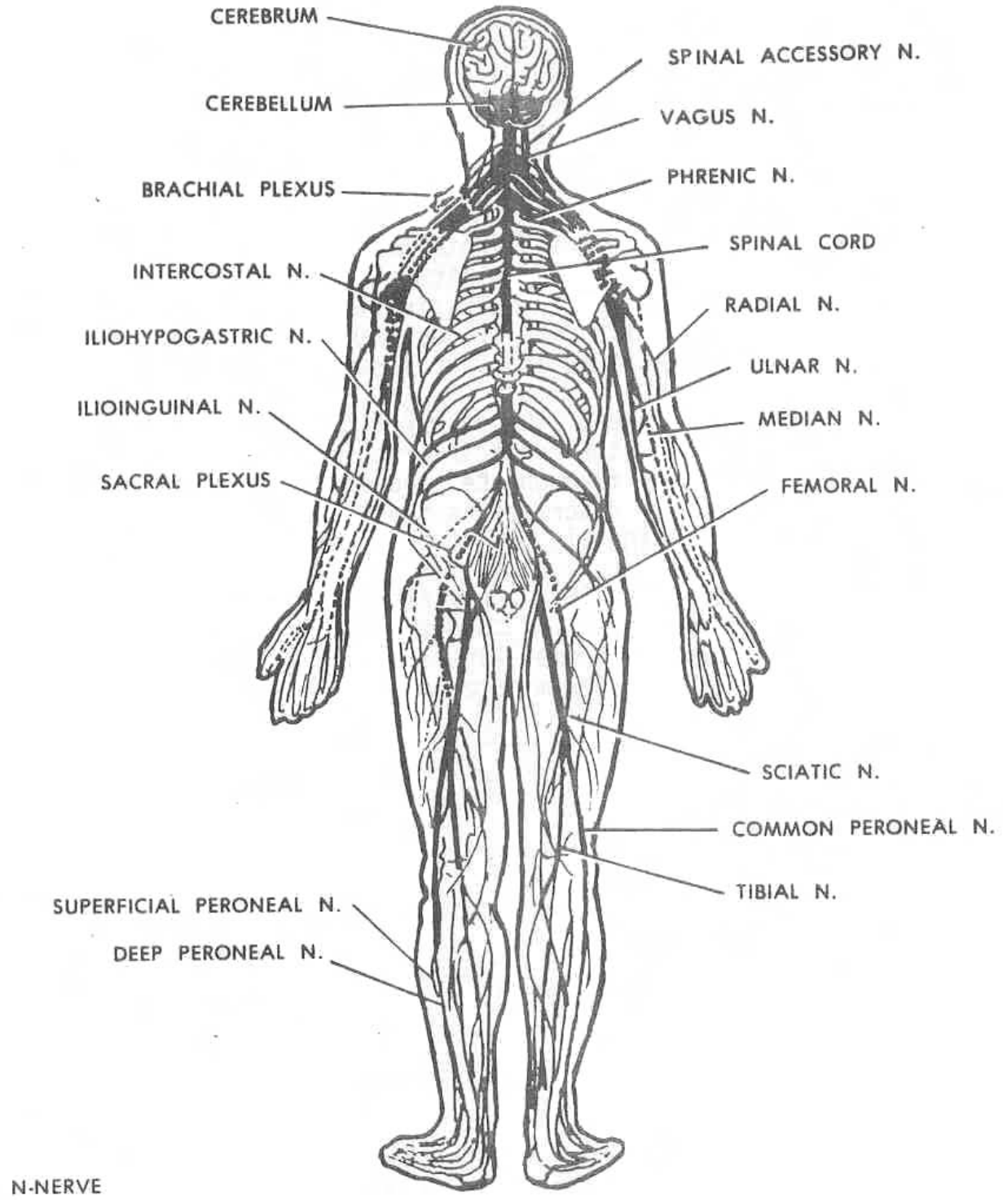

Figure 1-14. Peripheral nervous system.

1-12. RESPIRATORY SYSTEM

This system includes the lungs and a branched air passage leading into them. This passageway consists of the nose (or the mouth), pharynx, larynx, trachea, and two bronchi (see figure 1-15). The bronchi stem from the trachea (or windpipe). One bronchus passes into each lung. Within the lungs, the bronchi branch into smaller tubes. These tubes branch and rebranch many times to form a system of tiny air tubules. These tubules, called bronchioles, go to all parts of the lungs. They end in tiny air spaces called alveoli. In the alveoli, the exchange of oxygen and carbon dioxide occurs.

a. **Exchange of Oxygen and Carbon Dioxide.** The respiratory system provides the body with oxygen and eliminates carbon dioxide. In the lungs, oxygen enters the blood stream from the air and carbon dioxide passes out of the bloodstream into the air (external respiration). Throughout the tissues of the body, oxygen passes out of the bloodstream to the cells and carbon dioxide passes from the cells into the bloodstream (internal respiration).

b. **Utilization of Oxygen.** The cells of the body require a constant supply of oxygen to carry out the chemical processes necessary for life. Oxygen is taken into the body through the process of respiration (the act of breathing). Breathing may be described as the act of drawing air into the lungs (inhaling) and of forcing air out of the lungs (exhaling).

c. **The Process of Breathing.** Breathing is controlled automatically by a respiratory center in the brain. Breathing can be consciously controlled for short periods of time. The normal rate of breathing is 16 to 20 inhalations and exhalations per minute.

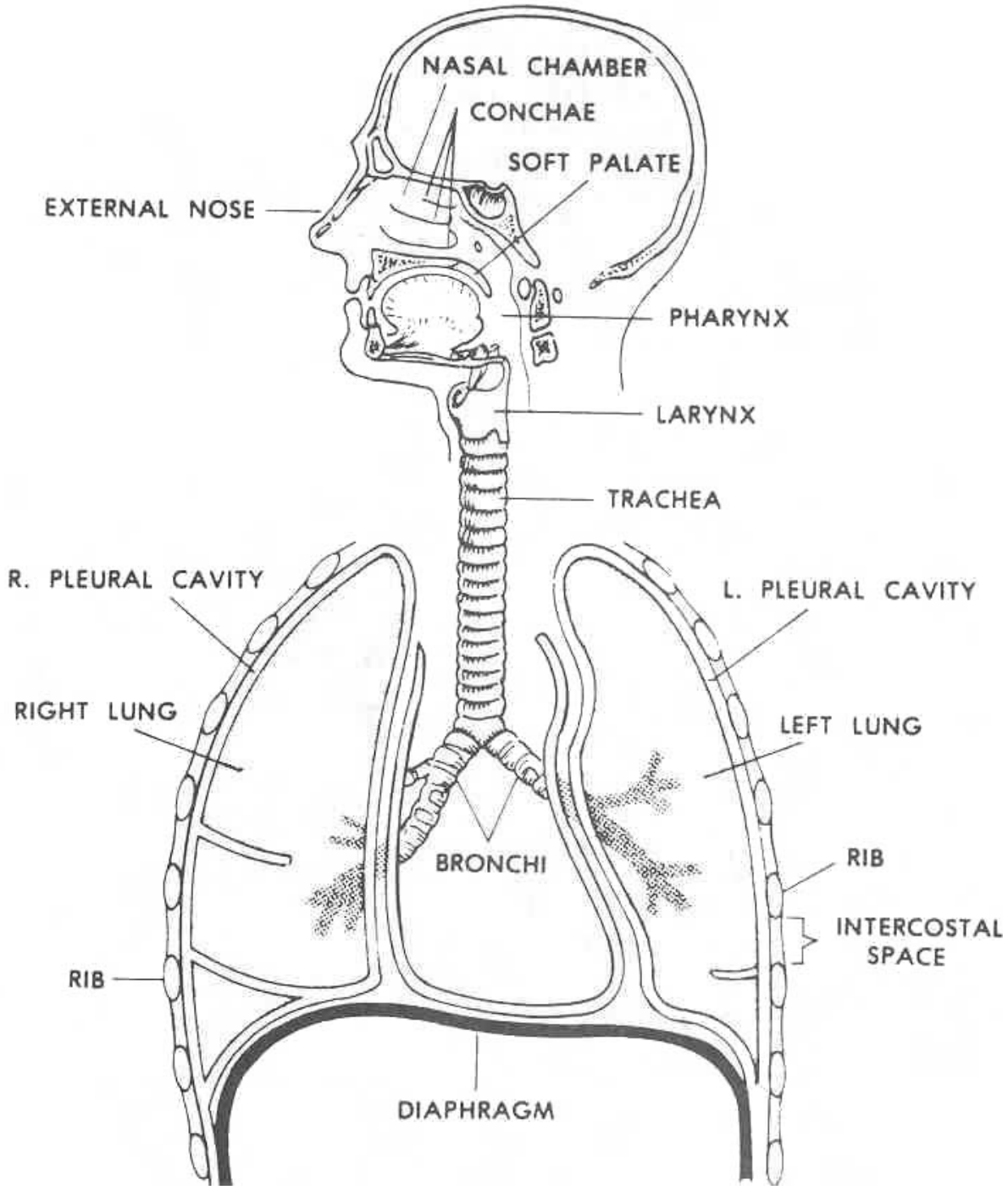

Figure 1-15. Respiratory system.

1-13. UROGENITAL SYSTEM

This system, also called genitourinary system, includes the organs that eliminate urinary wastes from the body and the organs of reproduction (see figure 1-16). The urinary organs include the kidneys, ureters, bladder, and urethra. The kidneys are located on each side of the spine, just above the small of the back. They filter wastes from the bloodstream. These wastes pass into the ureters as urine. The ureters are thin, muscular tubes which lead to the bladder. The bladder is a muscular organ for storing urine. The urethra is a tube which eliminates urine from the bladder to the outside of the body. The male reproductive system includes the two testes which produce cells called spermatozoa and male sex hormones. The female reproductive system includes the two ovaries which produce female reproductive cells called ova, or eggs, and female sex hormones. When a spermatozoon unites with an ovum, under the proper conditions, a single cell is formed. This single cell develops into a human being.

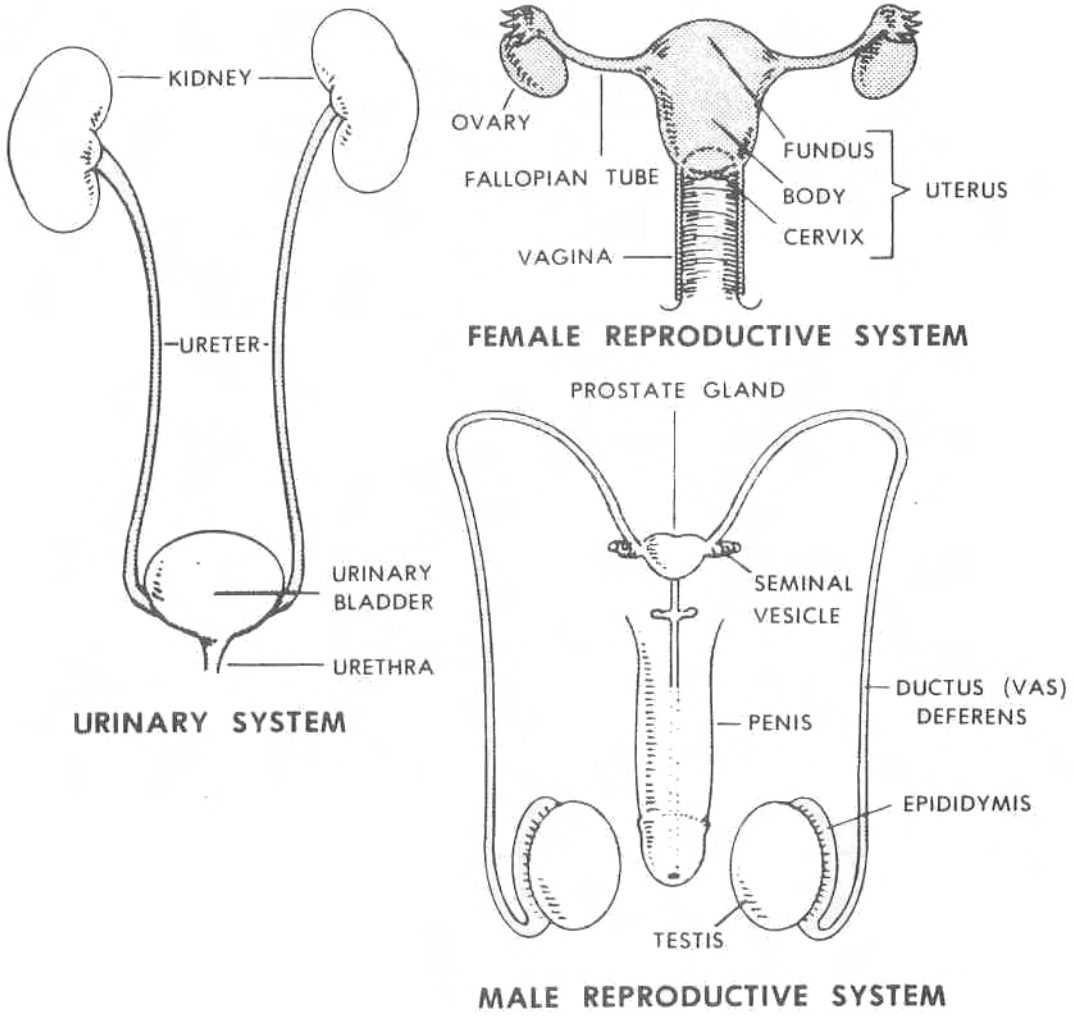

Figure 1-16. Urogenital system.

1-14. ENDOCRINE SYSTEM

This system includes the glands which secrete hormones into the bloodstream (see figure 1-17). Hormones are small in quantity but powerful in effect. Carried throughout the body by the blood, hormones influence growth, blood pressure, fluid balance, ability to use food, and sexual characteristics.

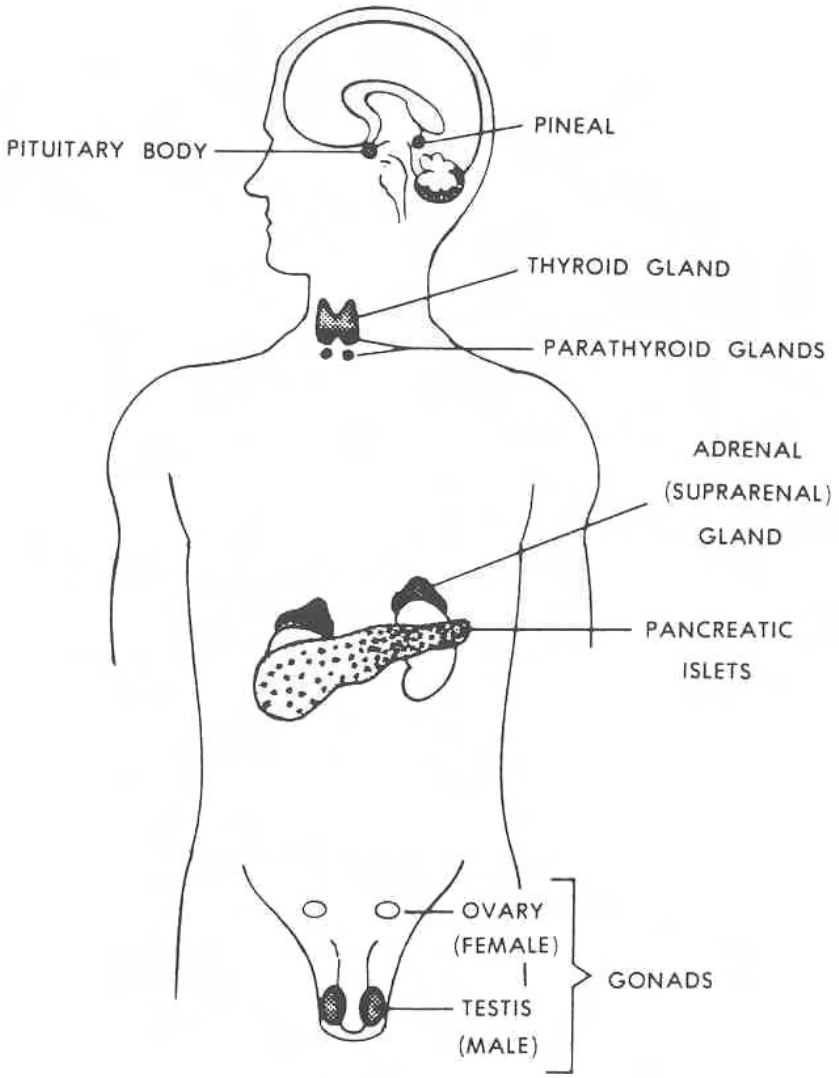

Figure 1-17. Endocrine glands.

Continue with Exercises

EXERCISES, LESSON 1

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the question or best completes the incomplete statement or by writing the answer in the space provided.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced after the answer.

1. Anatomy is the study of:

   a. The structure of the body.

   b. The relation of the parts of the body.

   c. The body's organs.

   d. The functions and activities of the parts of the body.

   e. Items "a," "b," and "c" above.

2. Physiology is the study of:

   a. The functions and activities of the parts of the body.

   b. The structure of the body.

   c. The relation of the parts of the body.

   d. The systems of the human body.

   e. Items "a" and "d" above.

SPECIAL INSTRUCTIONS FOR EXERCISES 3 THROUGH 5. Match each term in Column A to its definition in Column B. Mark your answers in the space provided.

COLUMN A	COLUMN B
____ 3. Nucleus	a. Surrounds and separates the cell from its environment. Through this, all the materials essential to metabolism are received and disposed of.
____ 4. Cytoplasm.	b. Controls all activities of the cell, including growth and reproduction.
___ 5. Cell membrane.	c. Responsible for most of the chemical activities of the cell.

SPECIAL INSTRUCTIONS FOR EXERCISES 6 THROUGH 9. Match each term in Column A to its definition in Column B. Mark your answers in the space provided.

COLUMN A	COLUMN B
___ 6. Muscle tissue.	a. Serves as a lining for vessels and other small cavities inside the body and as skin outside the body.
___ 7. Epithelial tissue.	b. Holds tissues together, supports tissues, and fills spaces
___ 8. Nerve tissue.	c. Has the ability to contract (shorten).
___ 9. Connective tissue.	d. Receives and transmits electrical impulses (messages).

SPECIAL INSTRUCTIONS FOR EXERCISES 10 THROUGH 12. Match each term in Column A to its definition in Column B. Mark your answers in the space provided.

COLUMN A	COLUMN B
___ 10. Tissue.	a. The basic functioning unit of the body.
___ 11. Organ.	b. A group of similarly-specialized cells that work together to perform a particular function.
___ 12. Cell.	c. A somewhat independent part of the body which performs a specialized function or functions.

13. The skin functions to protect:

    a. Inner tissues from _____.

    b. Underlying structures from _____ and _____.

14. The _____ is the largest organ of the body. Among other functions, the skin regulates body _____.

15. The adult human skeleton has _____ bones.

16. All of the following are found in a cross-section of skin EXCEPT:

    a. Sweat glands.

    b. Arteries and veins.

    c. Sebaceous glands.

    d. Epidermis.

    e. Epiphysis.

17. The porous, inner part of a bone is called the:

    a. Cortex.

    b. Spongiosa.

    c. Marrow.

    d. Periosteum.

18. Which of the following bones are parts of the head or neck?

    a. Scapula.

    b. Phalanges.

    c. Cervical vertebrae.

    d. Sacrum.

    e. Ulna.

19. The muscular system includes more than _____ muscles. Cardiac muscle is found in the muscular wall of the _____.

20. Involuntary muscles are another name for _____ muscle.

    a. Smooth.

    b. Cardiac.

    c. Striated.

SPECIAL INSTRUCTIONS FOR EXERCISES 21 THROUGH 23. Match the type of mulsle in Column A to its description in Column B. Mark your answers in the space provided.

COLUMN A		COLUMN B	
___	21. Striated.	a.	Found in various visceral organs where continuous automatic functions are necessary.
___	22. Smooth.	b.	A specialized type of involuntary muscle.
___	23. Cardiac.	c.	Skeletal muscles that can be consciously controlled.

24. Which of the following muscles are situated in the head or face?

    a. Iliopsoas.

    b. Deltoid.

    c. Quadriceps.

    d. Risorius.

    e. Trapezius.

25. The circulatory system includes the:

    a. _____.

    b. _____.

    c. _____.

    d. _____.

26. Complete the information concerning the human heart.

    a. The heart is a muscular, _____ - _____ organ.

    b. The upper chamber of the heart is the _____.

    c. The lower chamber of the heart is the _____.

    d. The phase in the cardiac cycle when the heart contracts is called _____.

    e. The phase in the cardiac cycle when the heart dilates (relaxes) is called _____.

    f. Normally, the heart contracts _____ to _____ times per minute.

27. In the average adult human body, there are about _____ pints of blood.

a. 11 to 12.

b. 10 to 11.

c. 13 to 14.

d. 12 to 13.

28. A wavelike expansion of the arteries is called the:

a. Systole.

b. Diastole.

c. Pulse.

d. Heartbeat.

SPECIAL INSTRUCTIONS FOR EXERCISES 29 THROUGH 32. Match the name of the blood component in Column A to its description in Column B. Mark your answers in the space provided.

	COLUMN A		COLUMN B
___	29. Plasma.	a.	Carry oxygen from the lungs to the tissues.
___	30. Erythrocytes.	b.	The liquid medium that carries food to the cells and waste products away from the cells.
___	31. Leukocytes.	c.	Aid in the clotting of blood.
___	32. Thrombocytes.	d.	Destroy foreign substances in the blood and the tissues.

33. Oxygenated hemoglobin is carried in:

    a. White blood cells.

    b. Plasma.

    c. Red blood cells.

    d. Platelets.

    e. Items "c" and "d" above.

34. All of the following have lymphocytic cells EXCEPT:

    a. The thymus.

    b. The spleen.

    c. Tonsils.

    d. The heart.

    e. Peyer's patches.

35. List the three kinds of blood vessels.

    a. _____.

    b. _____.

    c. _____.

36. According to figure 1-10, all of the following blood vessels are veins EXCEPT the:

    a. Right innominate.

    b. Subclavian.

    c. Internal jugular.

    d. Great saphenous.

    e. External carotid.

37. Select the lymph node that is NOT a part of the lymphatic system of the head and neck.

    a. Posterior auricular node.

    b. Axillary node.

    c. Submental node.

    d. Occipital node.

    e Submaxillary node.

38. All of the following are parts of the alimentary tract EXCEPT the:

    a. Larynx.

    b. Mouth.

    c. Pharynx.

    d. Rectum.

    e. Esophagus.

39. All of the following are accessory organs of the digestive system EXCEPT the:

    a. Salivary glands.

    b. Pancreas

    c. Intestinal glands.

    d. Spleen.

    e. Gallbladder.

40. What is the enzyme in the mouth that starts the chemical breakdown of starchy foods?

    _____.

41. When food is swallowed, what structure closes off the larynx?

    _____.

42. Complete the information related to the digestive system.

a. Chewed food is passed from the pharynx through the _____ by a wavelike motion of the muscular walls, called _____.

b. The action of several enzymes and an acid aid in the chemical breakdown of food. This occurs in the _____ and the resulting semifluid mass is called _____.

c. The digestion process is completed in the _____ , which is _____feet in length and _____ inch in diameter.

d. The main function of the large intestine is the recovery of _____. The large intestine is _____ feet in length and _____ inches in diameter.

e. The _____ is continuous with the large intestine and is only about 6 inches long. It receives _____ (waste products) from the large intestine and periodically expels it through the _____.

SPECIAL INSTRUCTIONS FOR EXERCISES 43 THROUGH 45. Match the term in Column A to its description in Column B. Mark your answers in the space provided.

	COLUMN A		COLUMN B
___	43. Central nervous system.	a.	Controls smooth muscles, the heart, sweat glands, digestive glands, the blood vessels, and some endocrine glands.
___	44. Peripheral nervous system.	b.	Controls specific body functions, such as movement, breathing, heartbeat, body temperature, speech, sight, and hearing.
___	45. Autonomic nervous system	c.	Controls all conscious body movements and reflex action.

46. Complete the information related to the nervous system.

    a. The central nervous system includes the _____ and the _____ _____.

    b. The control center of the body is the _____, located in the _____. The spinal cord is enclosed in the _____ _____ and is sometimes called the _____ .

    c. There are _____ pairs of cranial nerves that give off branches to the structures of the head and face. There are _____ pairs of spinal nerves that give off branches to the structures of the body from the neck down.

    d. Each nerve supplies a specific body area or structure (called _____ . When various nerve branches join together, they are said to _____.

    e. Most peripheral nerves contain both _____ fibers and _____fibers. The control of the autonomic nervous system is almost entirely _____ and subconscious.

47. The action of the cardiac muscle is controlled by the:

    a. Central nervous system.

    b. Autonomic nervous system.

    c. Peripheral nervous system.

48. The specialized cell designed to control electrical impulses generated in the nervous system is the:

    a. Sacral plexus.

    b. Bronchi.

    c. Neuron.

    d. Pons.

    e. Vagus nerve.

SPECIAL INSTRUCTIONS FOR EXERCISES 49 THROUGH 53. Match the structure of the respiratory system in Column A to its description in Column B. Mark your answers in the space provided.

	COLUMN A		COLUMN B
___	49. Larynx.	a.	Two branches of the air passageway, leading to the lungs.
___	50. Trachea.	b.	A system of tiny air tubules within the lungs.
___	51. Bronchi.	c.	Tiny air spaces for exchange of oxygen and carbon dioxide.
___	52. Bronchioles.	d.	Between the pharynx and the trachea, containing the vocal cords.
___	53. Alveoli.	e.	Carries air from the larynx to the bronchi.

54. What is the term for the air passage that enters directly into <u>one</u> of the lungs?

    a. Pleural cavity.

    b. Trachea.

    c. Bronchus.

    d. Larynx.

    e. Bronchi.

55. The normal rate of breathing is _____ inhalations and exhalations per minute.

a. 12 to 16.

b. 16 to 20.

c. 18 to 22.

d. 20 to 24.

SPECIAL INSTRUCTIONS FOR EXERCISES 56 THROUGH 61. Match the structure of the urogenital system in Column A to its description in Column B. Mark your answers in the space provided.

COLUMN A	COLUMN B
___ 56. Kidney.	a. Eliminates urine to the outside of the body.
___ 57. Ureter.	b. Produces spermatozoa and male sex hormones.
___ 58. Bladder.	c. Produces ova and female sex hormones.
___ 59. Urethra.	d. Stores urine.
___ 60. Testis.	e. Tubes which lead to the bladder.
___ 61. Ovary	f. Filters wastes from the bloodstream.

62. Under the proper conditions, a single cell is formed when a _____unites with an _____ . This single cell develops into a human being.

63. The endocrine system includes various _____ which secrete _____ into the bloodstream.

64. List the four endocrine glands in the head and neck.

a. _____.

b. _____.

c. _____.

d. _____.

65. According to the lesson, all of the following glands are part of the endocrine system EXCEPT the:

a. Adrenal gland.

b. Pituitary body.

c. Testis or ovary.

d. Pancreatic islets.

e. Thymus.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 1

1. e (para 1-1)
2. a (para 1-1)
3. b (para 1-2b)
4. c (para 1-2c)
5. a (para 1-2a)
6. c (para 1-3c)
7. a (para 1-3a)
8. d (para 1-3d)
9. b (para 1-3b)
10. b (para 1-3)
11. c (para 1-4)
12. a (para 1-2)
13. a. drying (dessication)
    b. infection; injury (para 1-6)
14. skin; temperature (para 1-6)
15. 206 (para 1-7)
16. e (figure 1-2)
17. b (para 1-7)
18. c (figure 1-3)
19. 350; heart (para 1-8)
20. a (para 1-8b)

21. c (para 1-8a)

22. a (para 1-8b)

23. b (para 1-8c)

24. d (figures 1-5 and 1-6)

25. Heart.
Blood.
Blood vessels.
Lymphatics (para 1-9).

26. a. cone-shaped.
b. atrium.
c. ventricle.
d. systole.
e. diastole.
f. 70; 80. (paras 1-9a, a(1), (2))

27. a (para 1-9b)

28. c (para 1-9a(3))

29. b (para 1-9b(1))

30. a (para 1-9b(2))

31. d (para 1-9b(2))

32. c (para 1-9b(2))

33. c (para 1-9b(2))

34. d (para 1-9d)

35. Arteries.
Capillaries.
Veins (para 1-9c).

36. e (figures 1-10, 1-9)

37. b (figure 1-11)

38. a (para 1-10)

39. d (para 1-10)

40. Ptaylin. (para 1-10a)

41. Epiglottis. (para 1-10b)

42. a. esophagus; peristalsis (para 1-10c).
    b. stomach; chyme (para 1-10d).
    c. small intestine; 21; 1 (para 1-10e)
    d. water; 5; 2 (para 1-10f)
    e. rectum; feces; anus (para 1-10f, g)

43. b (para 1-11a)

44. c (para 1-11b(2))

45. a (para 1-11c)

46. a. brain; spinal cord (para 1-11a)
    b. brain; cranium; spinal column; backbone (para 1-11a)
    c. 12; 31 (para 1-11b(1))
    d. innervation; anastomose (para 1-11b(1))
    e. motor; sensory; involuntary (paras 1-11b(1), 1-11c)

47. b (para 1-11c)

48. c (para 1-11)

49. d (para 1-12; figure 1-15)

50. e (para 1-12; figure 1-15)

51. a (para 1-12)

52. b (para 1-12)

53. c (para 1-12)

54. c (para 1-12)

55. b (para 1-12c)

56. f (para 1-13)

57. e (para 1-13)

58. d (para 1-13)

59. a (para 1-13)

60. b (para 1-13; figure 1-16)

61. c (para 1-13; figure 1-16)

62. spermatozoon; ovum (para 1-13)

63. glands; hormones (para 1-14)

64. a. Pituitary.
    b. Pineal.
    c. Thyroid.
    d. Parathyroid. (para 1-14; figure 1-17)

65. e (para 1-14; figure 1-17)

End of Lesson 1

LESSON ASSIGNMENT

LESSON 2	The Skull and the Jaws.
LESSON ASSIGNMENT	Paragraphs 2-1 through 2-13.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

2-1. Identify the six different bones of the skull.

2-2. Identify the bones in the face.

2-3. Identify the five major structures of the upper jaw (maxilla).

2-4. Identify the two major structure of the lower jaw (mandible).

2-5. Identify the four major muscles of mastication and the assisting muscles.

2-6. Identify the three structures and the function of the temporomandibular joint (TMJ).

2-7. Identify the three divisions of the cranial nerves and the nerves that supply the teeth and surrounding structures.

2-8. Identify how blood is supplied to the jaws and the teeth.

2-9. Identify the structure and function of the tongue.

2-10. Identify the three major pairs of salivary glands.

SUGGESTION After studying the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 2

THE SKULL AND JAWS

2-1. GENERAL

As an assistant to the dental officer, who provides professional treatment, the dental specialist must have a basic knowledge of the anatomy and physiology of the head.

2-2. SKULL

The human skull is the bony framework which gives the head its characteristic shape. The function of the skull is to protect the soft and vital tissues of the head, primarily the brain. The skull contains the fused flat bones of the cranium and the facial bones, including the mandible (lower jaw), which is freely movable. The cranium is the bony box housing the brain. The skull is composed of 22 bones, 8 in the cranium and 14 in the face. See figures 2-1, 2-2, and 2-3.

2-3. CRANIUM

The eight bones of the cranium are frontal, occipital, sphenoid, ethmoid, two parietal, and two temporal bones. They form the floor and the domelike vault that encloses and protects the brain. The cranial bones are fused at joints called the coronal suture. (A suture is a fused line of junction between two bones. It is an immovable joint.) At birth, the bones of the cranium are not fully fused and the sutures are soft. As the baby grows, the bones of the skull fuse firmly, making the skull a rigid box that does not permit expansion. This means that if bleeding occurs within the adult skull or if brain tissue swells, the increase in intracranial volume will increase pressure and damage to the brain tissue can occur.

a. **Frontal Bone.** This bone forms the forehead, the anterior (front) part of the cranial vault, and the roof of the orbits (eye sockets). Located within the frontal bone, just behind the eyebrows, are two air spaces called the frontal sinuses.

b. **Occipital Bone.** This bone makes up the posterior (back) part of the floor and the posterior wall of the cranial vault. It is the bone that supports the head on the spinal column. The spinal cord leaves the cranium through an opening in the occipital bone. This opening is called the foramen magnum. (A foramen is an opening in a bone which serves as a passageway for nerves and blood vessels.) When a patient is seated in the dental chair, the headrest should support the occipital bone.

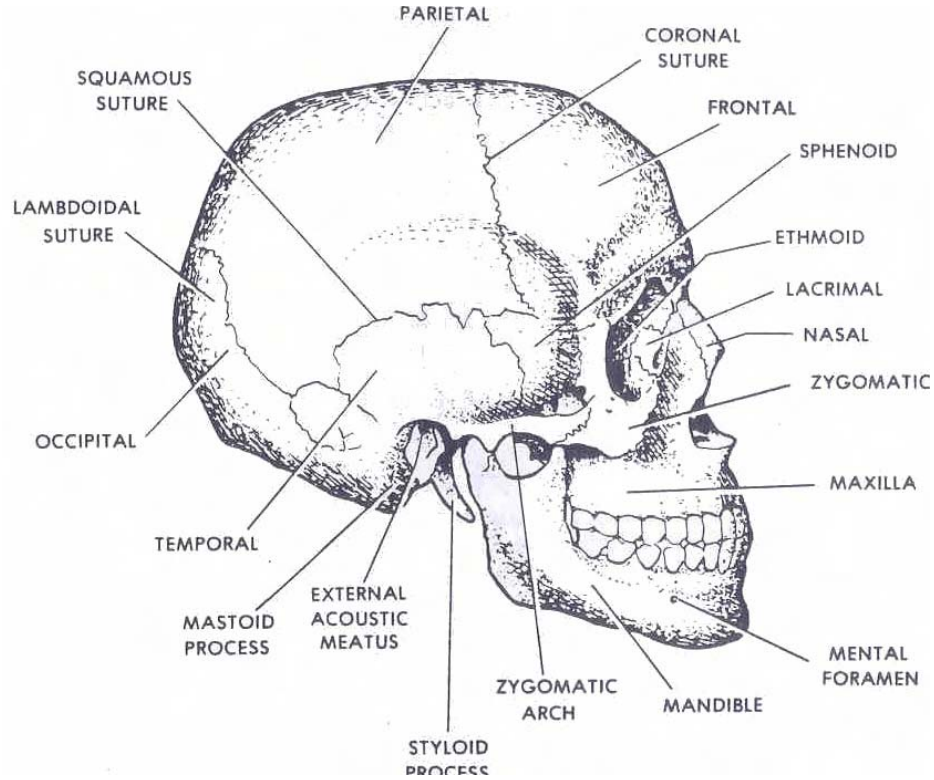

Figure 2-1. Side view of skull.

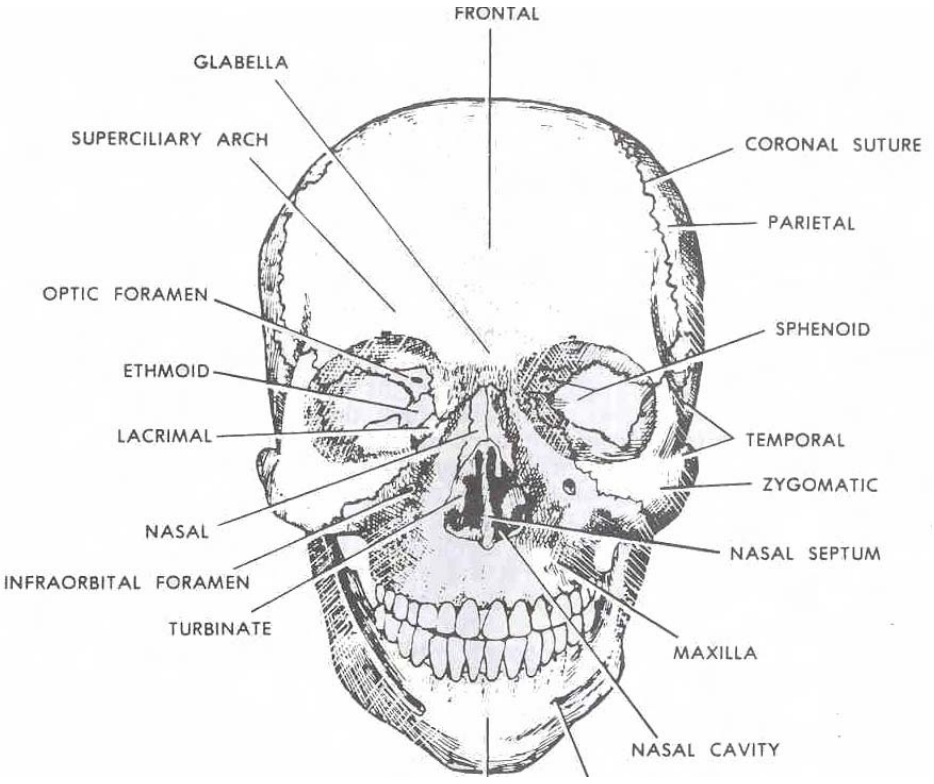

Figure 2-2. Front view of skull.

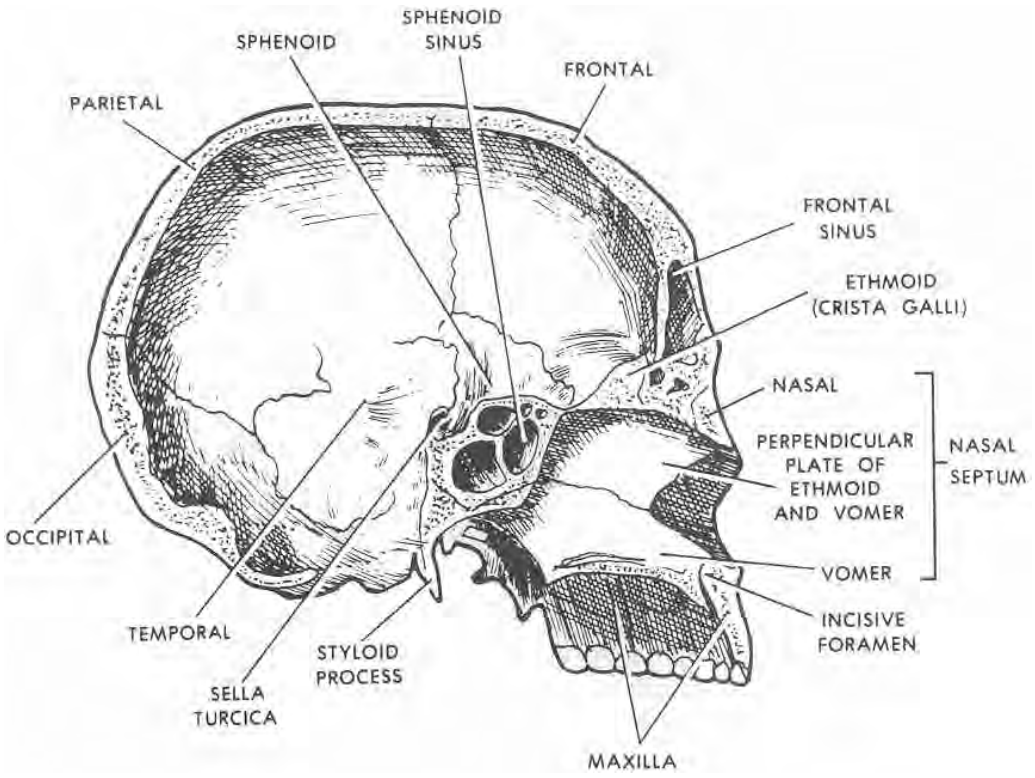

Figure 2-3. Skull (median section).

c. **Sphenoid Bone.** This bone forms part of the orbits and supports the posterior part of the upper jaw. It is the central part of the cranium base. The sphenoid air sinuses lie in the sphenoid bone. The pituitary gland lies in a bony socket called the sella turcica. The sella turcica is located on the superior aspect of the sphenoid bone. It transmits the optic nerve (nerve of sight).

d. **Ethmoid Bone.** This bone makes up the anterior (front) part of the base of the skull (between the orbits), the medial (toward center) wall of each orbit, part of the nasal septum, and the roof of the nose. It lies between the eyes and extends from the frontal bone to the sphenoid bone. The ethmoid bone transmits the olfactory nerve (nerve of smell).

e. **Parietal Bones.** These bones form a large part of the cranial vault. They extend from the frontal bone to the occipital bone. The two bones join at the midline on top of the cranium. The joining of these bones forms the sagittal suture. From this suture, these bones extend down and out to near the top of the external ear where they meet the two temporal bones.

f. **Temporal Bones.** These two bones form the sides and part of the cranium base. They contain the organs of hearing and equilibrium. The external acoustic meatus (an opening or a canal) in the side of each bone forms a passage from the external ear to the middle ear which lies within each bone.

(1) Zygomatic process. This is a projection from the center of the lateral aspect of each temporal bone. (A process is an extension or projection from a bone.) It extends forward from the top of the meatus to join the zygomatic bone of the face. This extension forms a part of the zygomatic arch (cheekbone) and can be felt with the fingers. The zygomatic process is often involved in facial fractures.

(2) Temporomandibular joint. On the under surface of the zygomatic process, just in front of the ear, is a depression called the mandibular or glenoid fossa. (A fossa is a hollow area or depression in a bone.) This fossa and the condyle (a rounded prominence at the end of a bone) of the mandible (the lower jaw) form the temporomandibular joint. Movements of the joint can be felt if the fingers are placed just below and in front of the ear canal when the mouth is opened and closed. It is sometimes referred to as the TMJ.

(3) Mastoid process. This projection of the temporal bone may be felt as a knob of bone jutting down behind the ear. The mastoid process contains spaces called mastoid air cells. These air cells communicate with the middle ear. The mastoid process serves as an attachment for several muscles which move the head.

2-4. FACE

The face is an extremely important part of the anatomy. It has a wide range of attributes which involve your appearance and essential activities, such as swallowing, seeing, and breathing. Many tissues of the face are involved in dental treatment, and the dental specialist must have a thorough understanding of this anatomical area. Since the bones of the jaws (the maxilla and the mandible) are of special interest in dentistry, they are considered in separate paragraphs. Other bones are presented in "a" through "f" below. Of these, the first two are used as landmarks for dental radiographs. The 14 bones of the face are listed in table 2-1.

Mandible	1 Bone
Maxillae	2 Bones (plural of maxilla)
Zygomatic	2 Bones
Lacrimal	2 Bones
Nasal	2 Bones
Inferior nasal conchae	2 Bones
Palatine	2 Bones
Vomer	1 Bone

Table 2-1. Bones of the face.

a. **Zygomatic Bones.** These bones (right and left) form the lower and outer edges of each orbit. They also form that part of each zygomatic arch nearest the eye (the prominent part of the cheekbone). The zygomatic bone and the zygomatic process of the temporal bone form the zygomatic arch. The anterior edge of the zygomatic bone joins the maxilla.

b. **Nasal Bones.** These bones (right and left) are long, thin pieces of bone that form the upper part of the bridge of the nose. The lower portion or anterior (front) part of the nasal septum is composed of cartilage.

c. **Lacrimal Bones.** These bones (right and left) form small parts of the medial walls of the orbits. They transmit the nasolacrimal duct from the eye to the nose or the nasal fossa.

d. **Inferior Nasal Conchae.** These bones (right and left) are scroll-like bones lying horizontally along the lateral walls of the nasal cavity (nose), being the skeletal portion of the inferior nasal conchae. The bony elements of the middle and superior conchae are extensions of the lateral parts of the ethmoid bones.

e. **Palatine Bones.** These bones (right and left) join in the midline to form the posterior part of the hard palate. They also form part of the floor and lateral walls of the nasal cavity and part of the floor of the orbits.

f. **Vomer.** It forms the inferior (lower) and posterior part of the nasal septum. It is the vertical partition separating the right and left nasal cavities.

2-5. JAWS

The jaws are the bony parts of the face that hold the teeth and form the framework of the mouth. They are paired bones and form the middle of the face. The upper jaw is called the maxilla and the lower jaw is called the mandible. Any malformations or malfunctioning of the jaws, whether from accidental or natural causes, may have serious consequences for the individual's health and happiness. The sociopsychological importance of the face cannot be overemphasized.

2-6. UPPER JAW (MAXILLA)

The upper jaw (maxilla) is an irregular bone formed from the right and left maxillary bones, which unite along the midline of the face (see figure 2-2). It joins in the palate (roof of the mouth) at the intermaxillary suture or at the median palatal suture. The maxilla is considered the key to the architecture of the face. All the bones of the face, except the mandible, come in direct contact with the maxilla, that is, they have sutural contact. The maxilla consists of a body which gives shape to the face and forms part of the orbits and nasal cavity. Within the body of each maxillary bone is a large cavity called the maxillary sinus (or the antrum of Highmore). The maxilla also consists of four processes--nasal, zygomatic, alveolar, and palatal. The maxillary sinus and the alveolar process are important landmarks in dental radiography.

a. **Maxillary Sinus.** The maxillary sinus (antrum of Highmore) is a large pyramidal cavity in the maxilla with its base toward the nose. This cavity is separated from the nasal cavity by a very thin wall of bone (see figure 2-4). Within this wall is an irregular opening connecting the sinus with the nasal cavity above the inferior nasal conchae. The floor or lower wall of the sinus is formed by the maxillary alveolar process (see paragraph "d" below). It is level with the floor of the nose. Projecting into the floor of the sinus are many cone-shaped processes. These processes correspond to the roots of the maxillary teeth (usually bicuspids and molars) located in the region of the sinus. Because of this proximity, the pain of a sinus infection and that of a toothache are sometimes hard to tell apart.

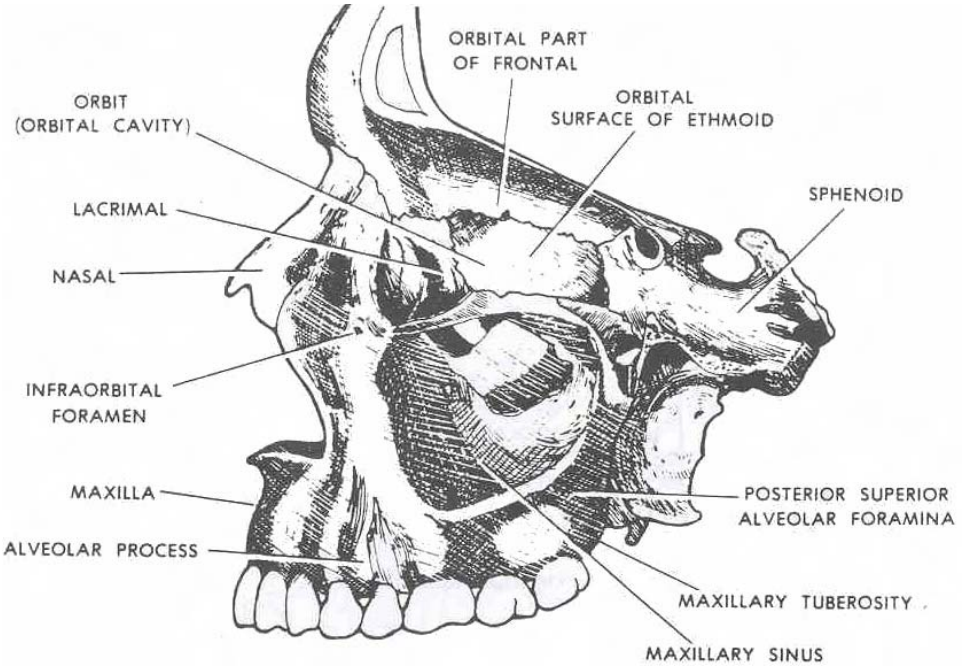

Figure 2-4. Lateral aspect of maxilla and adjacent bones.

b. **Nasal Process.** This gives shape to the nose by forming part of the lateral wall. The nasal process forms a union with the nasal bone. The right and left nasal bones, with the nasal process of the right and left maxillary bones, form the anterior and side walls of the nasal cavity.

c. **Zygomatic or Malar Process.** This is a projection of the maxillary bones which joins the projections of the zygomatic bones. The zygomatic process is commonly referred to as the cheekbone, forming the eminence of the cheek under the eye.

d. **Maxillary Alveolar Process.** The maxillary alveolar process is an extension of the lower surface of the body of the maxilla. It forms a horizontal horse-shoe shaped ridge with the opening of the horseshoe toward the throat. This part of the maxilla is thick and composed of a spongy or porous type of bone.

(1) <u>The tooth sockets</u>. The function of the alveolar process is to hold and support the maxillary teeth. Teeth are embedded within the bone of the alveolar process in deep depressions or bony sockets called alveoli. Each alveolus conforms closely to the shape of the root of the tooth it contains. Roots are supported within the alveoli by connective tissue called the periodontal membrane or the periodontal ligament (see figure 2-5). When teeth are lost, the alveolus gradually disappears. This happens partly through a filling in of their deeper parts and partly through resorption (loss) of the bone and a simultaneous shrinkage of their soft parts. This is an important consideration when these teeth are replaced with dentures.

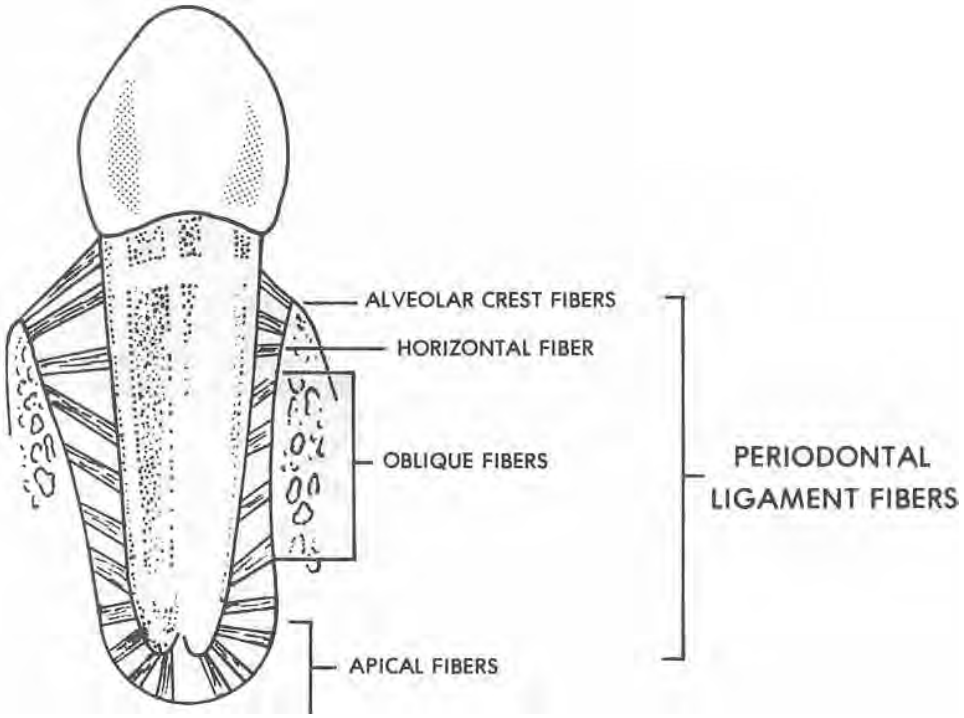

Figure 2-5. Periodontal ligament.

(2) Landmarks. Behind the most posterior tooth on each side of the maxilla is a small round prominence, called the maxillary tuberosity. The maxillary tuberosity is a landmark used in prosthetic dentistry and radiography. Just posterior to the maxillary tuberosity, where the maxilla and palatine bones unite, there is a notch or groove called the hamular notch or pterygo-maxillary notch. The hamular notch is also used as a landmark in determining the posterior border of a maxillary denture.

e. **Palatal Process.** This projection is thick and strong and forms much of the floor of the nasal cavity and palate (roof of the mouth). Its inferior surface, uniting with the palatal process of the maxillary bone of the opposite side, forms the anterior three fourths of the hard palate (see figure 2-6). The posterior one fourth of the hard palate is formed by the two palatine bones.

(1) Incisive foramen. Located in the midline of the hard palate, just behind the two central incisors, is an opening called the incisive foramen. Into this opening, emerge two canals called incisive canals. Through these canals pass the blood vessels and the nerves supplying the soft tissues covering the anterior part of the hard palate.

(2) Premaxilla. In the early development of the maxilla, an anterior pair of bones (premaxilla) is formed. This pair of bones fuses early with the maxilla to form the single upper jaw. Developmental defects, such as a cleft palate or a cleft lip, occur along these suture lines between the premaxillary and maxillary bones.

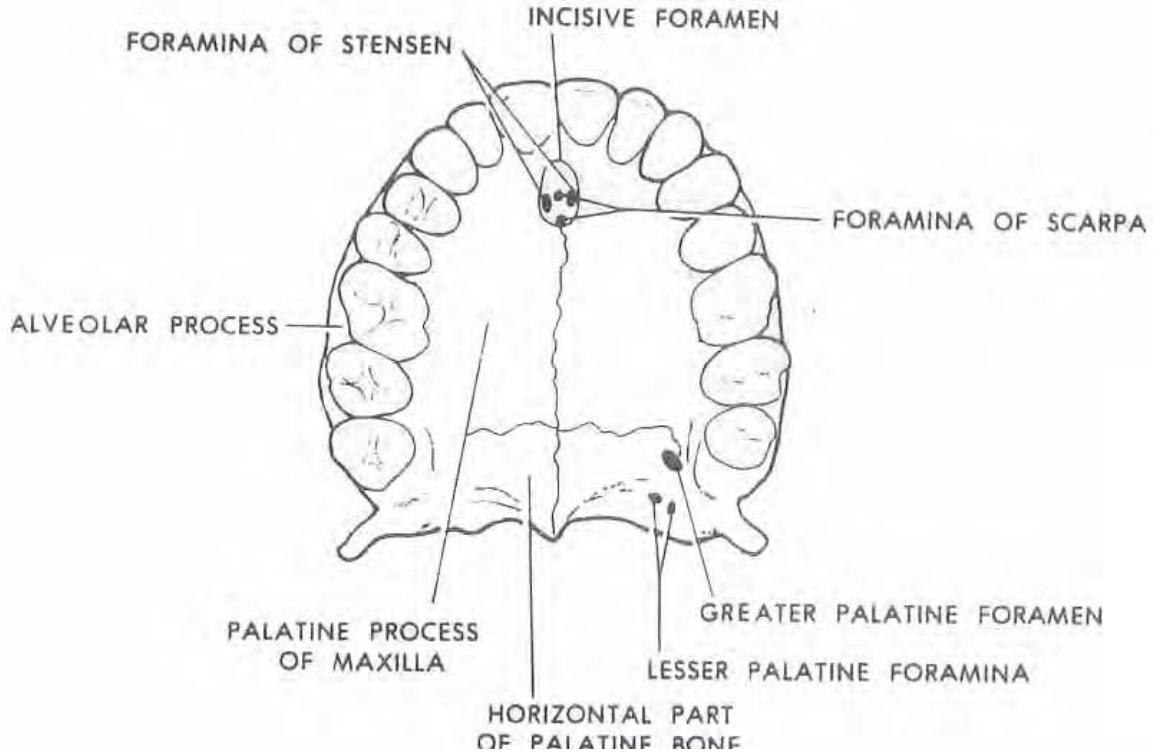

Figure 2-6. The palatal surface of the maxilla.

2-7. THE LOWER JAW (MANDIBLE)

The lower jaw (mandible) is the largest bone in the face and forms the lower face. It is the only freely movable bone of the face and is the movable portion of the temporomandibular joint. The right and left mandibles are joined at the chin by an invisible suture. These two bones appear to be one bone and are referred to as one bone. See figure 2-2. The mandible consists of a body with two vertical extensions called the rami (one ramus on each side). On the body of the mandible, as with the maxilla, is the mandibular alveolar process (a projection from the bone) which contains the roots and the alveoli (bony sockets) of the mandibular teeth.

a. **Body.** The anterior part of the mandible (the body) lies horizontally at the base of the face. It is composed of strong, hard bone. It is shaped like a horseshoe, corresponding to the maxillary alveolar process. The lower anterior part of the mandible forms a triangular prominence called the mental process. This is the bony chin, a feature unique to humans. The body has an external (outer) and internal (inner) surface (figures 2-7 and 2-8) and an inferior (lower) and superior (upper) border.

(1) Mental foramina. On both the right and left external surfaces of the mandible is a mental foramen which is located midway between the inferior and superior border. The mental foramina are usually between the apical portions of the first and second bicuspids, occasionally below the second bicuspid, and rarely below the first bicuspid. The mental foramina are small openings for the passage of blood vessels and nerves. These blood vessels and nerves supply a part of the lower lip and the skin of the chin.

(2) Mandibular alveolar process. This process is the upper part of the body of the mandible. The mandibular alveolar process is in the form of a ridge in which the teeth are embedded in the alveoli. When teeth are extracted, the alveoli disappear through a combination of filling in and resorption, as in the maxilla.

b. **Rami.** The posterior part of the mandible consists of two vertical extensions called rami. They form the upper part of the jawbone. Each of the two rami is broad, flat, and roughly quadrangular in shape. The upper border of each ramus ends in two projections, one anterior and one posterior. The base of each ramus forms the angle of the jaw below the ear.

(1) Coronoid process. The anterior projection on the ramus is the coronoid process. This process serves as an attachment for the temporalis muscle.

(2) Condyloid process. The posterior projection is the condyloid process. This process ends in a semi-cylindrical head called the condyle. The condyle, with its articular disk, approximates a depression. This depression is called the mandibular fossa. The mandibular fossa is located on the lower surface of the temporal bone. The condyle, articular disk, and fossa together form the temporomandibular joint.

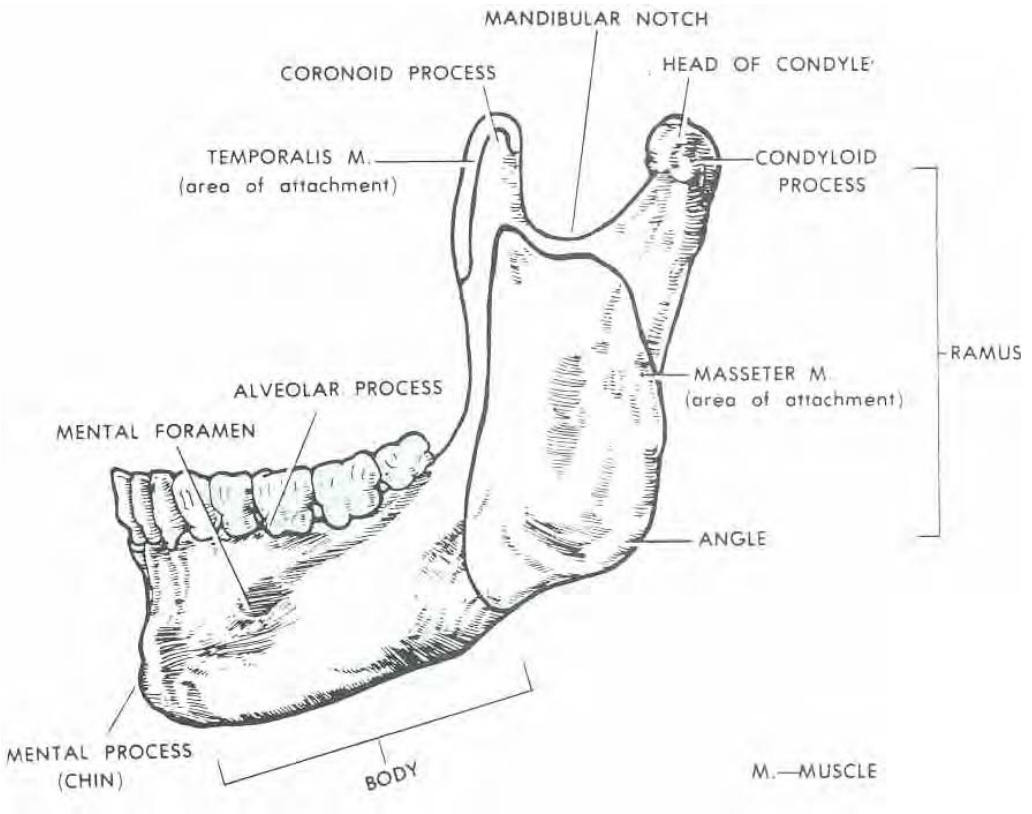

Figure 2-7. Outer surface of half of mandible.

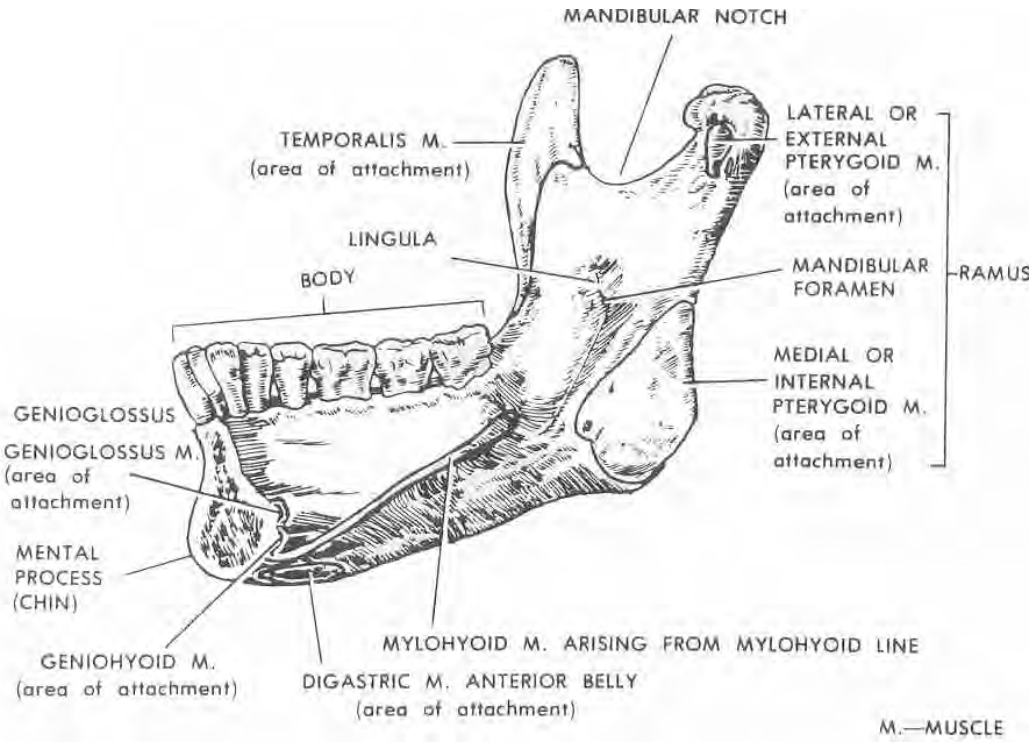

Figure 2-8. Inner surface of half of mandible.

(3) Mandibular (sigmoid) notch. Between the coronoid process and the condyloid process is a U-shaped space called the mandibular notch.

(4) Mandibular foramina. Near the center, on the inner surface of each ramus, is a mandibular foramen. These two foramina are openings of the mandibular canals. The canals pass through the mandible near the apices of the mandibular teeth. They carry the blood vessels and nerves that supply the teeth. They also supply most of the soft tissues supporting the teeth as well as the lower lip and chin. The foramina are important anatomical landmarks when administering local anesthesia on the mandibular nerve.

c. **Fractures.** The mandible is frequently fractured in automobile accidents. Fractures that occur in the region of the angle of the mandible are not common because of heavy muscular attachment. The most common fractures of the mandible occur at or behind the mental foramen. Note in figure 2-8 that the assisting muscles of mastication that pull the jaw downward are attached anterior to this fracture site.

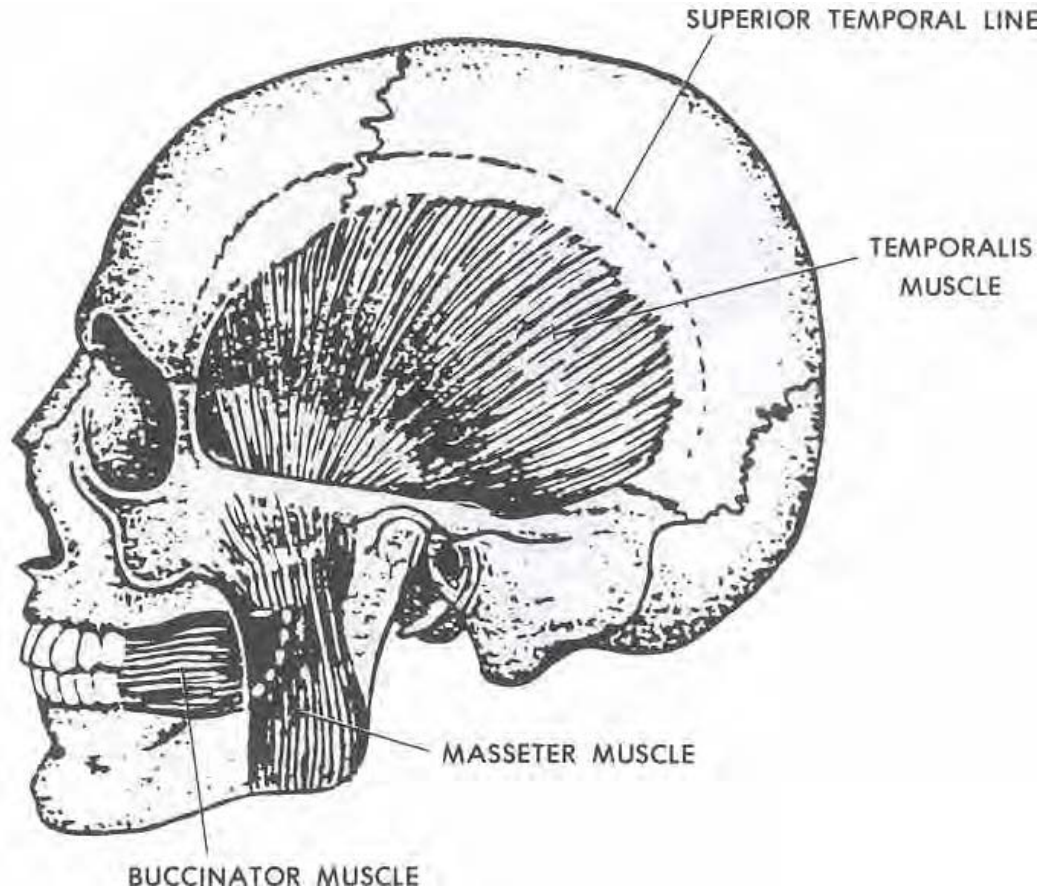

Figure 2-9. Masseter and temporalis muscles.

2-8. MUSCLES OF MASTICATION

Four pairs of muscles are considered the major muscles of mastication. These muscles are used for chewing and swallowing food. The masseter, the temporalis, and the medial pterygoid raise the mandible against the maxilla with considerable force. The fourth pair of muscles, the lateral pterygoids, act to thrust the mandible forward. Acting with other muscles, it opens the mouth. See figures 2-9, 2-10, and 2-11.

a. **Masseter.** The masseter is one of the primary muscles that close the jaws and exerts pressure on the teeth, particularly in the molar region.

b. **Temporalis.** The temporalis muscle is a fan-shaped muscle that attaches along the side of the head. Like the masseter, it closes the jaws. Because of its posterior horizontal fibers, it can also pull the mandible backward.

c. **Medial Pterygoid.** Together with the masseter and temporalis muscles, the medial pterygoid muscle elevates the mandible against the maxilla. The combined action of the three muscles creates a very strong masticating pressure between the opposing maxillary and mandibular posterior teeth.

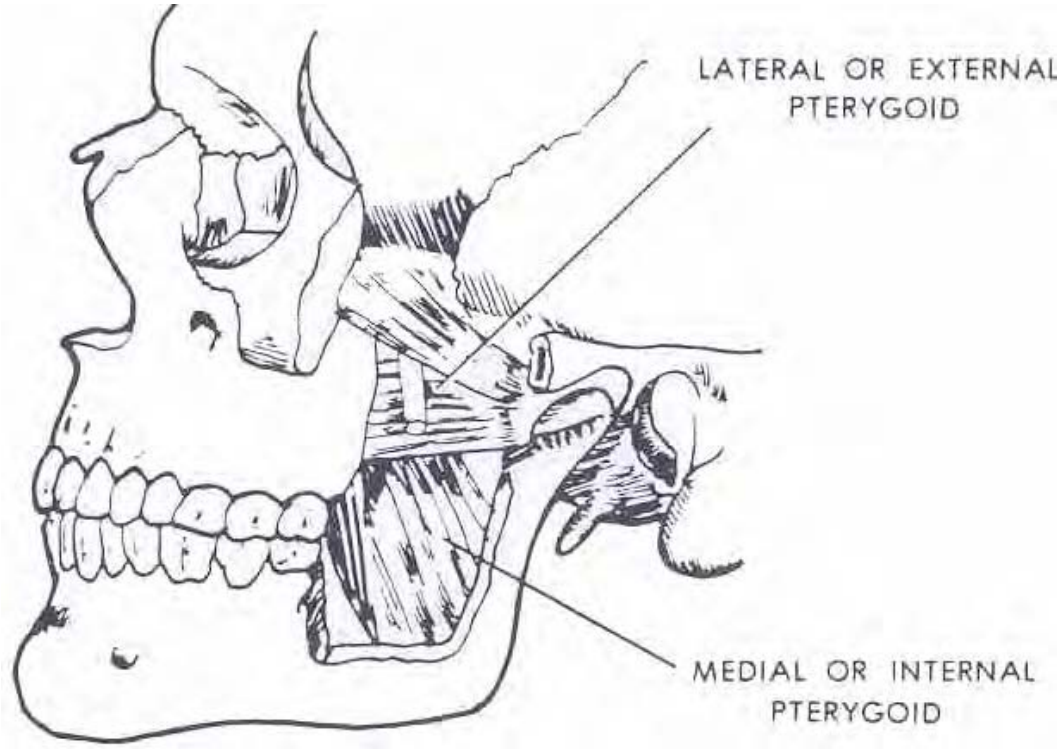

Figure 2-10. Medial and lateral pterygoid muscles.

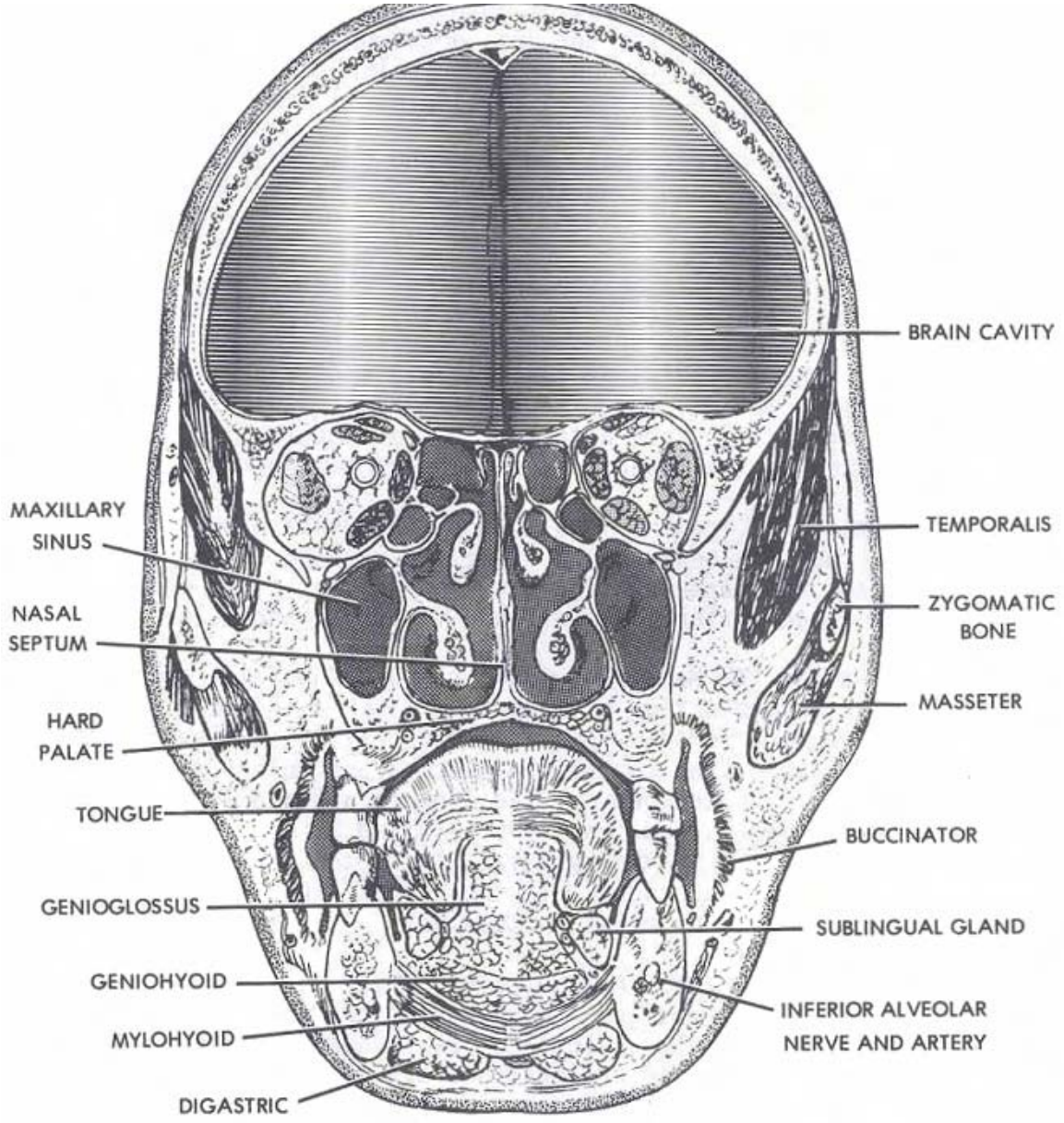

Figure 2-11. Front view of skull, cross section.

d. **Lateral Pterygoid.** The main action of the lateral pterygoid muscle is to draw the condyle and the articular disk forward while opening the mouth. This protrusive movement is accomplished when the right and left muscles act as one. Alternate contractions of the right and left muscles produce the sideward movements of the mandible used during mastication.

e. **Other Muscles of Mastication.** The buccinator is an important facial muscle used in mastication. There are also four assisting muscles of mastication listed below.

(1) Buccinator. The primary action of the buccinator (or cheek) muscle is to compress the cheek, thus moving food between the teeth during the chewing or grinding process. See figure 2-11.

(2) Assisting muscles. The mouth is opened by the lateral pterygoid muscle, assisted by the digastric, mylohyoid, geniohyoid, and genioglossus muscles (see figure 2-11). See figure 2-8 for the areas of attachment of these assisting muscles of mastication.

2-9. TEMPOROMANDIBULAR JOINT (TMJ)

The temporomandibular joint (TMJ) makes possible the various movements of the mandible (see figure 2-12). It allows for the up, down, forward, backward, and side to side movements. All movements of the mandible and the functioning of the teeth are closely associated with the TMJ. The structures of the TMJ and some information about how they function follow.

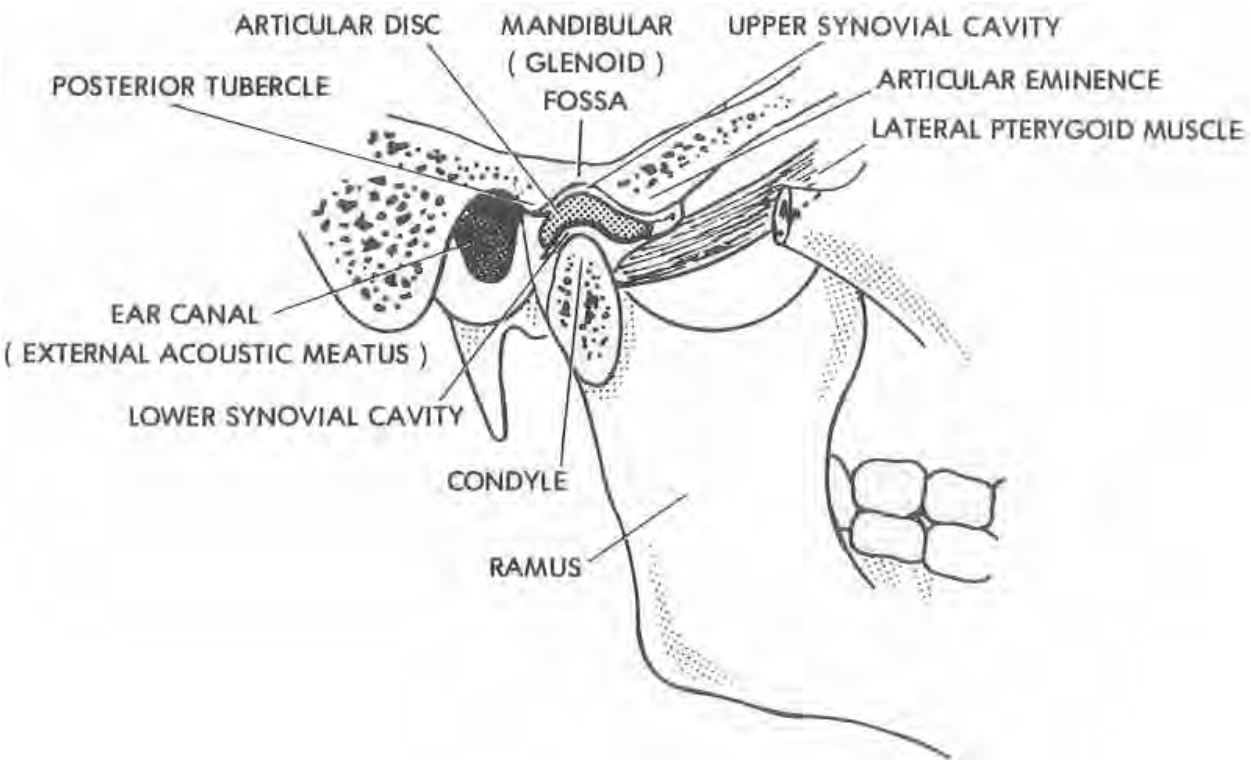

Figure 2-12. Temporomandibular joint, lateral cross-section view.

a. **Bones.** The temporomandibular joint derives its name from the two bones that form the joint, the temporal bone and the mandible. The condyloid process of the mandible and the mandibular fossa of the temporal bone form the joint. The condyle moves (articulates) inside the fossa and makes the movements of the mandible possible. It provides for up and down movements (elevation and depression), forward and backward movements (protrusive and retrusive), and side-to-side movements (lateral and rotational).

b. **Articular Disc.** The articular disc is a thin, biconcave, oval plate made of fibrous tissue, located between the mandibular fossa and the condyle of the mandible and the articular tubercle (posterior tubercle) of the temporal bone. The disc divides the TMJ into upper and lower cavities, each having synovial membranes which secrete synovial fluid to lubricate the joint. The edges of the disc are attached to the capsular ligament and, in front, it is attached to the lateral pterygoid muscle.

c. **Ligaments.** A ligament is a tough, fibrous band that connects bones. There are four ligaments that limit the extreme movement of the mandible. These are the capsular ligament, the lateral (temporomandibular) ligament, the sphenomandibular ligament, and the stylomandibular ligament.

d. **Movements of the Mandible.** The articulating joint of the mandible allows for a combination of movements, such as hinge, lateral, and protrusive movements. Different types of teeth perform various functions (incisors and cuspids for cutting, bicuspids and molars for crushing) The articular disc is situated between the condyle and the fossa to allow for the many different movements and functions required by different teeth. To contain the TMJ and to seal in the synovial fluid, the TMJ is encapsulated by the capsular ligament with a synovial lining. Thus, the TMJ is protected from wear and can absorb minor blows to the jaw.

e. **Use of Articulators.** Articulators, metal instruments used in the making of dentures, are designed to reproduce the movements of the mandible. The temporomandibular joint and jaw movements vary widely from person to person. Nonadjustable articulators are designed to reproduce the average articulation measurement for most individuals. The vast majority of prosthetic restorations can be accomplished using average jaw movements. For those situations where more precise reproduction of jaw movements is required, adjustable articulators are available.

2-10. NERVE SUPPLY OF THE JAWS AND TEETH

Twelve pairs of cranial nerves arise in the brain and give off branches to the structures of the head and face. These nerves leave the cranial cavity through foramina in the base of the cranium. The fifth cranial nerve (the trigeminal nerve) is the largest of the twelve pairs. See figure 2-13. It is of particular importance in dentistry since it provides the nerve supply to the jaws and the teeth. The fifth cranial nerve contains both motor and sensory fibers. Thus, it has a motor root supplying motor impulses to the muscles of mastication and a sensory root supplying sensory impulses from the structures of the head and face. Before leaving the cranial cavity, the sensory root divides into three branches or divisions.

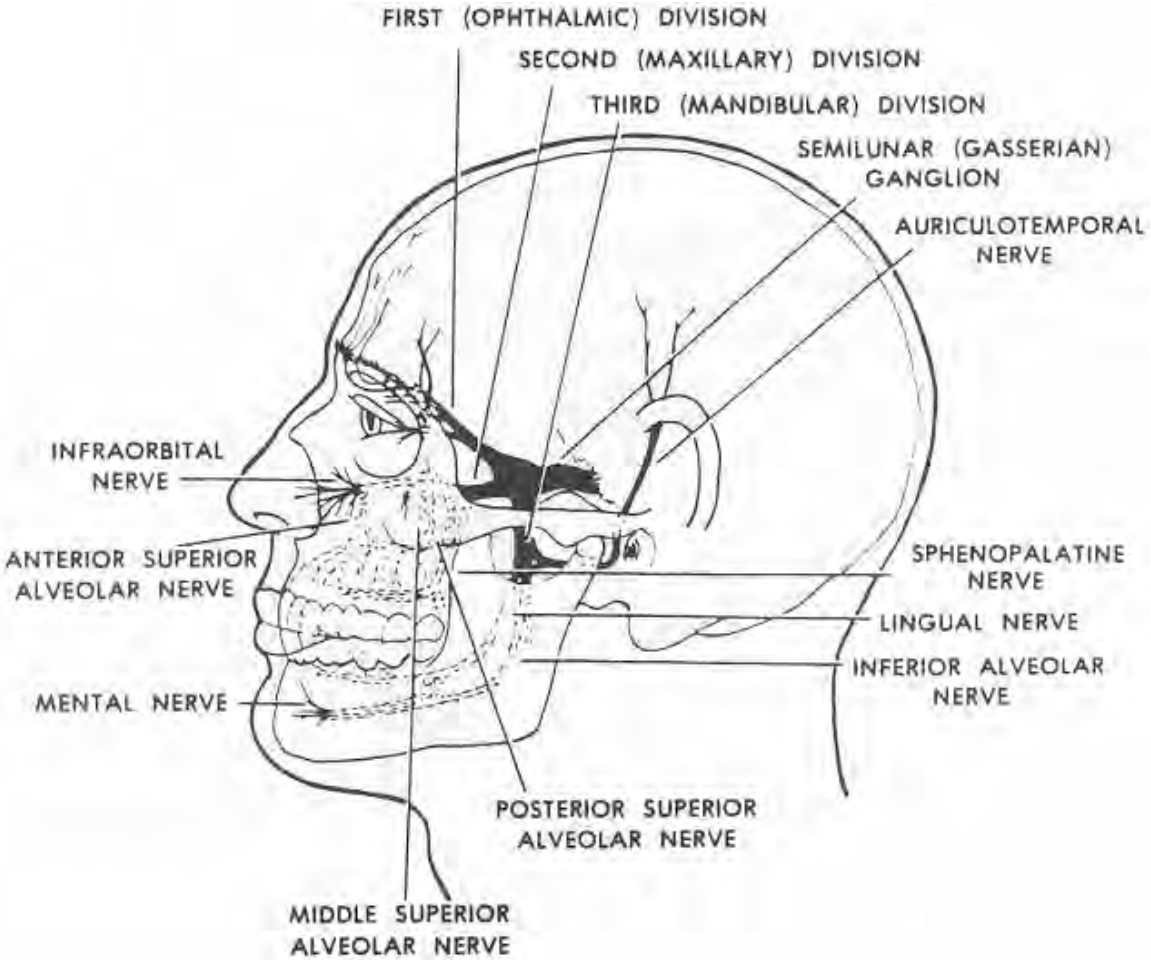

Figure 2-13. Trigeminal nerve and its major divisions.

a. **Ophthalmic Nerve or First Division.** This division supplies sensation to the eyes, the tear-producing glands, the mucous lining of the nose, the eyelids, the eyebrows, and the forehead.

b. **Maxillary Nerve or Second Division.** This division supplies sensation to the central part of the face, including the maxillary bone, all the maxillary teeth, the soft tissues of the hard palate, and the soft tissues surrounding the teeth. It contains no somatic motor fibers.

(1) The maxillary teeth. The maxillary nerve on each side passes forward in the floor of the orbit of the eye. It first gives off the posterior superior alveolar branch to the three maxillary molars. When in the floor, the maxillary nerve gives off a middle superior alveolar branch to the maxillary bicuspids and mesial root of the first molar. Then, the maxillary nerve gives off an anterior superior alveolar branch to the maxillary incisors and cuspid.

(2) The palatal area. The maxillary nerve on each side gives off a palatine nerve, which has an anterior, middle, and posterior branch. The anterior palatine nerve emerges upon the hard palate through the greater palatine foramen, and passes forward nearly to the incisor teeth where it ends with fibers of the nasopalatine nerve. It supplies the gingiva (gum tissue), the mucous membrane, and the glands of the hard palate and part of the soft palate. The middle and posterior palatine nerves reach the soft palate area through the lesser palatine foramina and give off branches to the uvula, tonsil, and soft palate.

(3) The nasopalatal area. Another branch of the maxillary nerve gives rise to the nasopalatine nerve. This nerve descends to the roof of the mouth through the incisive canal and communicates with the corresponding nerve of the opposite side and with the anterior palatine nerve.

c. **Mandibular Nerve or Third Division.** This division supplies sensation to the mandible and the teeth. It contains somatic motor fibers as well as sensory nerve fibers. (The first two divisions are primarily sensory.) This nerve passes downward to enter the mandible through the mandibular foramen. Before entering the foramen, it gives off branches to the muscles of mastication and a large sensory branch to the tongue. Thus, it provides motor impulses for mastication and general sensation to the anterior two thirds of the tongue, the mandible and the mandibular teeth, the soft tissues of the tongue, the soft tissues of the floor of the mouth, and the soft tissues surrounding the teeth.

2-11. BLOOD SUPPLY OF THE JAWS AND TEETH

a. **Arterial Blood.** Arteries carry blood from the heart to the tissues of the body. The principal arteries supplying the head and the neck are the common carotid arteries. These arteries ascend within the tissues of the neck, one on the right side and one on the left side. See figure 2-14.

(1) The internal carotid. At the level of the hyoid bone, each common artery divides into an internal carotid and an external carotid. The internal carotid supplies the tissues of the cranium and the eyes.

(2) The external carotid. The external carotid with its eight branches, supplies the exterior of the head, face, and much of the neck. The external carotid, just above its division from the common carotid, gives off the lingual artery. The lingual artery supplies the tongue. Just above the origin of the lingual artery, it gives off another branch, the facial artery. This artery supplies the soft tissues of the side of the face.

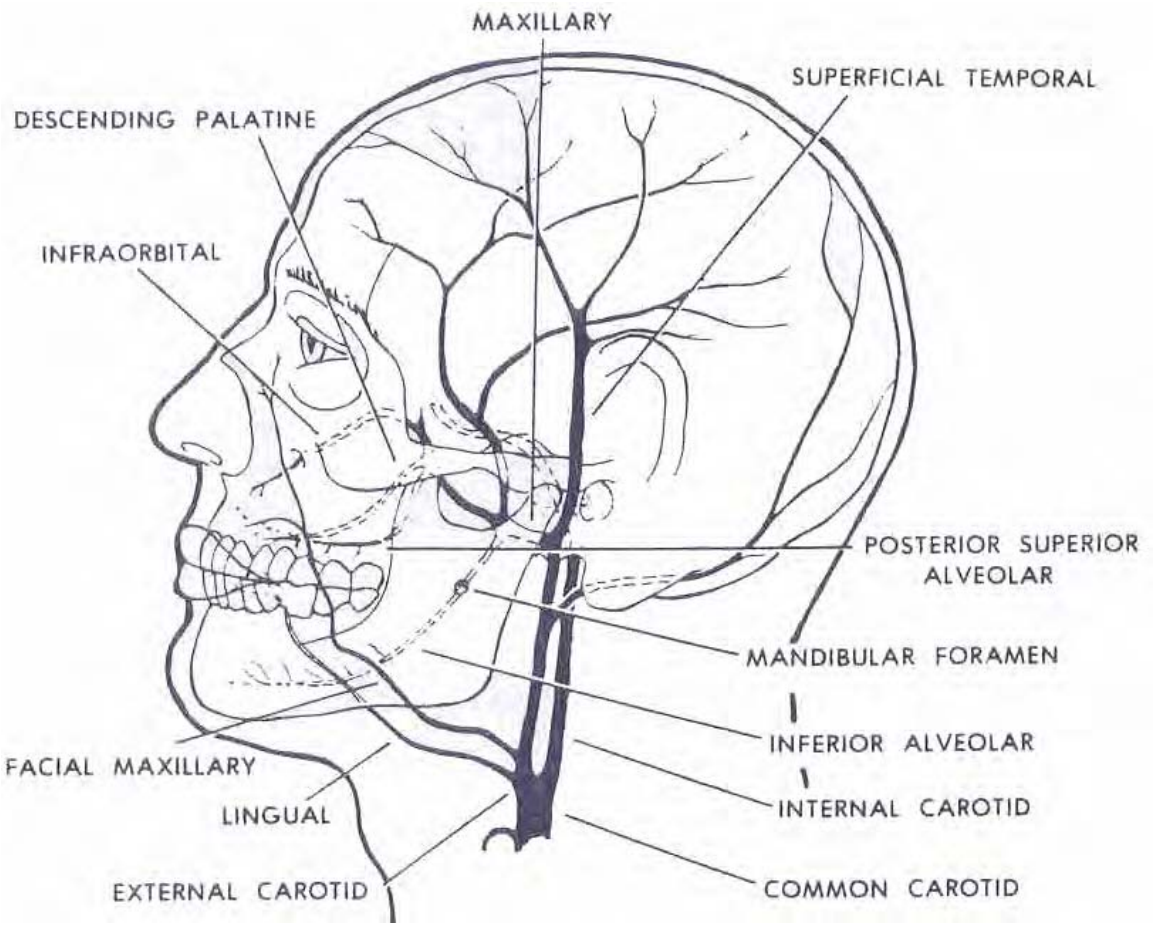

Figure 2-14. The common carotid artery and its branches.

(3) The maxillary artery. At the level of the lower part of the ear, the external carotid divides into two main terminal branches. These two branches are the maxillary artery and the superficial temporal artery. See figure 2-14. It is from the maxillary artery that various branches arise, supplying the bones of the jaws, the teeth, and their supporting tissues. It is this artery that is of particular interest in dentistry.

b. **Venous Blood.** Veins carry blood from the tissues of the body back to the heart, following the same general arrangement as the arteries. The major veins from the brain and the facial structures join the internal jugular vein. See figure 2-15.

(1) The cavernous sinus. Part of the venous system within the skull is enclosed between the two layers of the dura mater, which is the tough, fibrous membrane that envelops the brain. There is a channel for these veins which is called the cavernous sinus. See figure 2-15.

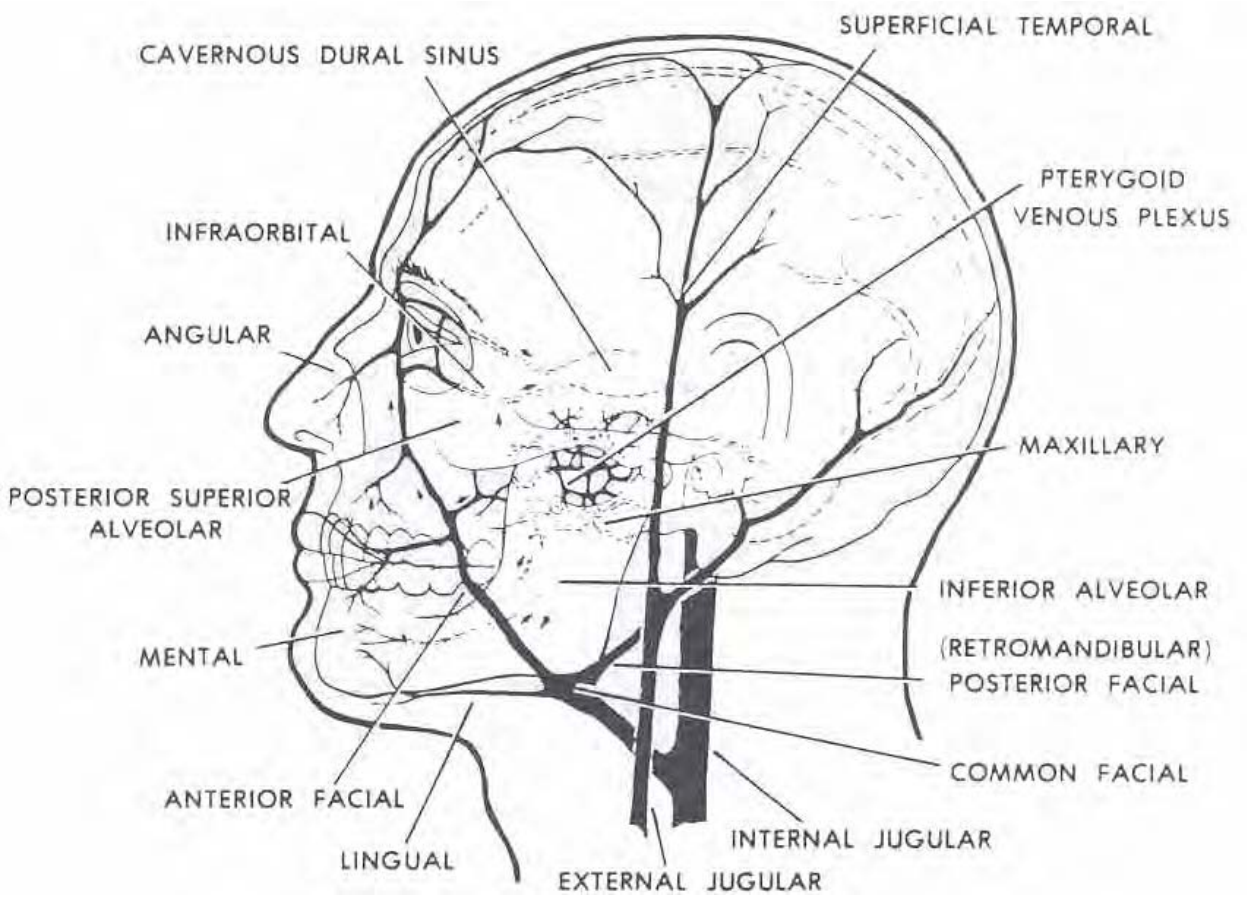

Figure 2-15. Veins of the head.

(2) The danger area of the face. Some veins of the face, particularly in the upper lip and the nose area, are directly joined to the cavernous sinus. See figure 2-16. Excessive irritation or aggravation of infected tissues, whose venous drainage is connected to the cavernous sinus, may result in a spread of infection to the cavernous sinus and then to the brain. For this reason, particular caution should be used to avoid needless aggravation of infected tissue in these areas. This venous drainage pattern is of particular importance since the veins of the face contain no valves as do veins in other parts of the body.

(3) Seriousness of infection. An infection in the facial area, to include the maxillary anterior teeth, can travel upward and rearward into the cavernous sinus. This may cause a cavernous sinus thrombosis or clotting of the blood in that area. Stopping the blood flow in the cavernous sinus would then cut off the flow to other parts of the brain. Lack of blood flow to the brain deprives it of oxygen and causes brain damage or death. Therefore, any infection in the upper teeth or facial area needs to be treated by the dental officer immediately.

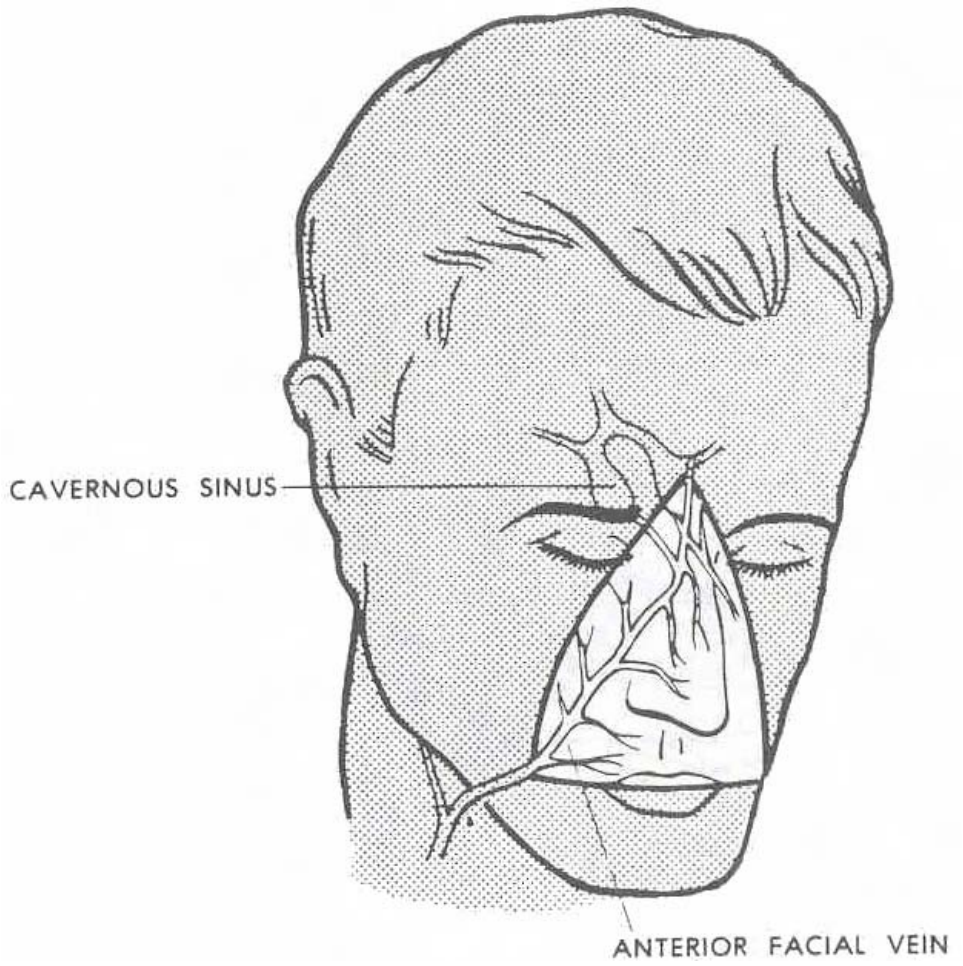

Figure 2-16. Danger area of the face.

2-12. TONGUE

The tongue is a muscular structure occupying most of the space in the mouth when closed. The thin anterior part is freely movable. The posterior part has a broad muscular attachment both to the hyoid bone and to the mandible.

a. **Papilla.** Situated on the surface of the tongue are many tiny tissue projections called papilla. The taste buds are found on some of the papilla and make the tongue the principal organ for the sense of taste.

b. **Uses of the Tongue.** The tongue is important in the production of speech, aids in mastication (chewing and grinding), and aids in swallowing food.

2-13. SALIVARY GLANDS

The three major pairs of salivary glands are the parotid glands, the submandibular glands, and the sublingual glands (see figure 2-17). They empty their secretions (saliva) into the oral cavity. The functions of saliva are cleansing, lubricating, promoting taste, and converting starches into simple sugar. The consistency, chemical composition, and rate of flow of saliva are contributing factors to potential diseases or abnormalities.

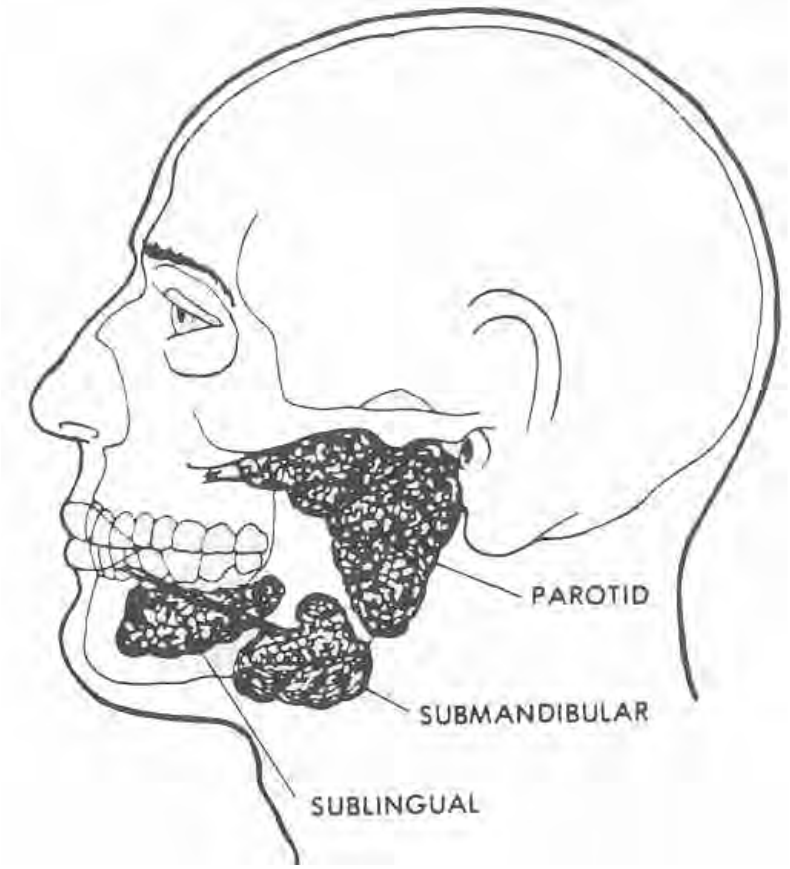

Figure 2-17. Major salivary glands.

a. **Parotid Glands.** These glands are the largest of the three salivary glands. They are located on each side of the face just below and in front of the ear.

b. **Submandibular Glands.** These glands are located in the floor of the mouth behind and somewhat below the body of the mandible, just forward of the angle of the jaw.

c. **Sublingual Glands.** These glands are the smallest of the three salivary glands. They are located just below the mucous membrane in the floor of the mouth, beneath the lateral aspects of the tongue.

Continue with Exercises

EXERCISES, LESSON 2

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the question or best completes the incomplete statement or by writing the answer in the space provided.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced after the answer.

SPECIAL INSTRUCTIONS FOR EXERCISES 1 THROUGH 6. Match each bone of the cranium in Column A to its description in Column B. Mark your answers in the space provided.

Column A	Column B
___ 1. Frontal.	a. Forms a large part of the cranial vault. The joining of these bones forms the sagittal suture.
___ 2. Occipital.	b. Contains the organs of hearing and equilibrium. The external acoustic meatus is in the side of each bone.
___ 3. Sphenoid.	c. Makes up the front part of the base of skull, between the eyes, and makes up part of the nose. Transmits the olfactory nerve.
___ 4. Ethmoid.	d. Makes up the central part of the cranium base. Forms part of the eye sockets and the back part of the upper jaw. It transmits the optic nerve and has a bony socket that holds the pituitary gland.
___ 5. Parietal.	e. Makes up the back part of the cranial vault and the back part of the floor of the cranial vault. It supports the head on the spinal column
___ 6. Temporal.	f. Forms the forehead, the roof of the eye sockets, and the front part of the cranial vault.

7. When a patient is seated in the dental chair, the headrest should support the:

    a. Ethmoid bone.

    b. Temporal bones.

    c. Occipital bone.

    d. Parietal bones.

8. An opening in a bone which serves as a passageway for nerves and blood vessels is a:

    a. Foramen.

    b. Sinus.

    c. Process.

    d. Fossa.

    e. Meatus.

9. A hollow or depression in a bone is a(n):

    a. Foramen.

    b. Suture.

    c. Orbit.

    d. Meatus.

    e. Fossa.

10. An extension or projection from a bone is a:

    a. Fossa.

    b. Suture.

    c. Condyle.

    d. Process.

    e. Septum.

11. There are _____ bones in the face.

    a. 8.

    b. 14.

    c. 22.

    d. 28.

12. According to the lesson, which one of the following bones is NOT a facial bone?

    a. Palatine.

    b. Lacrimal.

    c. Vomer.

    d. Inferior nasal conchae.

    e. Ethmoid.

13. Which one of the following bones joins the maxilla at the anterior edge?

    a. Zygomatic.

    b. Nasal.

    c. Inferior nasal conchae.

    d. Palatine.

    e. Vomer.

14. According to the lesson, which one of the following is more often involved in facial fractures?

    a. Vomer.

    b. Mastoid process.

    c. Zygomatic process.

    d. Temporomandibular joint.

15. The external acoustic meatus is found in the:

    a. Ethmoid bone.

    b. Sphenoid bone.

    c. Zygomatic process.

    d. Temporal bone.

    e. Mastoid process.

SPECIAL INSTRUCTIONS FOR EXERCISES 16 THROUGH 18. Match each structure of the temporal bone in Column A to its description in Column B. Mark your answers in the space provided.

	Column A	Column B
___ 16.	Zygomatic process	a. A knob of bone jutting down behind the ear, which serves as an attachment for several muscles which move the head.
___ 17.	Temporomandibular joint.	b. This extension forms a part of the cheekbone.
___ 18.	Mastoid process	c. Where the glenoid fossa and the condyle of the mandible come together.

19. List the 14 bones of the face.

a. _____(l bone)

b. _____(2 bones)

c. _____(2 bones)

d. _____(2 bones)

e. _____(2 bones)

f. _____(2 bones)

g. _____(2 bones)

h. _____(1 bone)

20. Complete the following statements related to the face.

a. The _____ are the bony parts of the face that hold the teeth and form the framework of the mouth.

b. Essential activities associated with the face are:

(1) _____

(2) _____

(3) _____

c. The _____ is the upper jaw.

d. The_____ is the lower jaw.

SPECIAL INSTRUCTIONS FOR EXERCISES 21 THROUGH 24. Match each structure of the upper jaw in Column A to its description in Column B. Mark your answers in the space provided.

	Column A	Column B
___ 21.	Nasal process.	a. Forms the eminence of the cheek under the eye.
___ 22.	Malar process.	b. Gives shape to the nose by forming part of the lateral wall.
___ 23.	Maxillary alveolar process.	c. Forms much of the roof of the mouth and the floor of the nasal cavity.
___ 24.	Palatal process.	d. Forms a horizontal, horse-shoe shaped ridge, with the opening toward the throat.

25. Located within the body of each maxillary bone is a large cavity called the:

a. Maxillary tuberosity.

b. Hamular notch.

c. Antrum of Highmore.

d. Cavernous sinus.

26. The incisive foramen is found in the _____, just behind the two central incisors.

    a. Maxillary alveolar process.

    b. Malar process.

    c. Maxillary sinus.

    d. Nasal process.

    e. Palatal process.

27. Complete the following statements related to the alveolar process.

    a. The function of the alveolar process is to hold and support _____.

    b. Teeth are embedded in deep depressions or bony sockets called _____.

    c. Each _____ conforms closely to the shape of the root of the tooth it contains.

28. The roots of the teeth are supported within the tooth sockets by connective tissue called the _____ _____ or the _____ _____.

29. The largest bone in the face is the:

    a. Mandible.

    b. Maxilla.

    c. Vomer.

    d. Zygomatic.

30. Which one of the following is NOT part of the ramus of the mandible?

    a. Coronoid process.

    b. Condyloid process.

    c. Sigmoid notch.

    d. Mandibular foramina.

    e. Mental foramen.

31. The bony chin, unique to humans, is formed by the:

    a. Malar process.

    b. Condyloid process.

    c. Mandibular alveolar process.

    d. Mental process.

    e. Coronoid process.

32. The angle of the jaw below the ear is formed by the base of the:

    a. Coronoid process.

    b. Mental process.

    c. Ramus.

    d. Vomer.

33. Select the structure that is important during the administration of a local anesthetic to the mandibular nerve.

a. Mental foramina.

b. Mandibular foramina.

c. Foramina of stensen.

d. Incisive foramen.

e. Greater palatal foramen.

SPECIAL INSTRUCTIONS FOR EXERCISES 34 THROUGH 38. Match each muscle of mastication in Column A to its description in Column B. Mark your answers in the space provided.

	Column A	Column B
___ 34.	Masseter.	a. Closes the jaws and pulls the mandible backward.
___ 35.	Temporalis.	b. Opens the mouth, producing forward and sideward movements.
___ 36.	Medial pterygoid.	c. Close the jaws, exerting pressure in the molar region.
___ 37.	Lateral pterygoid.	d. Elevates the mandible against the maxilla.
___ 38.	Buccinator.	e. Positions food between the teeth by compressing the cheek.

39. List the smaller muscles that assist in opening the mouth.

a. The _____.

b. The _____.

c. The _____.

d. The _____.

40. As depicted in figure 2-9, the muscle of mastication that is fan-shaped is the:

    a. Masseter.

    b. Lateral pterygoid.

    c. Buccinator.

    d. Medial pterygoid.

    e. Temporalis.

41. As depicted in figure 2-8, the muscles that assist the lateral pterygoid in opening the jaw are attached to the _____ part of the mandible.

    a. Anterior.

    b. Posterior.

    c. Medial.

42. The most common fracture of the jaw (mandible) is at or just behind the:

    a. Point of attachment of the geniohyoid muscle.

    b. Mandibular foramen.

    c. Point of attachment of the mylohyoid muscle.

    d. Mental foramen.

    e. Neck of the condyle.

43. List the two bones that form the temporomandibular joint.

    a. The _____ of the mandible.

    b. The _____ of the temporal bone.

44. Complete the following statements related to the articular disk.

    a. The articular disk is a _____, _____, _____, plate made of fibrous tissue.

    b. It is located between the mandibular _____ and the _____ of the mandible.

    c. The synovial membrane secretes _____ fluid to _____ the joint.

    d. In front, the articular disk is attached to the _____muscle.

45. What limits the extreme movement of the mandible?

    a. Synovial membrane.

    b. Ligaments.

    c. Buccinator muscle.

    d. Articular disc.

    e. Lateral pterygoid muscle.

46. The synovial cavity is most closely related to the:

    a. Muscles of mastication.

    b. Maxillary alveoli.

    c. Temporomandibular joint.

    d. Mandibular ramus.

    e. Nerve and blood supply of the jaws and teeth.

47. Articulators are metal instruments used in the maki g of dentures.

    a. _____ articulators are designed to reproduce the jaw movements for the average individual.

    b. When more precise reproduction of jaw movement is required, _____ articulators are available.

48. Complete the following statements related to the cranial nerves.

    a. There are _____ pairs of cranial nerves.

    b. The largest of the pairs is the _____ cranial nerve.

    c. It is also called the _____ nerve. It provides nerve supply to the jaws and to the teeth.

    d. The motor root supplies motor impulses to the muscles of _____.

    e. The sensory root supplies sensory impulses from the structures of the _____ and the _____.

49. For each structure in Column A, identify the appropriate major division of the trigeminal nerve that serves the structure Column B. Items in column B may be used more than once. Mark your answers in the space provided.

Column A.	Column B
___ (1) Mucous lining of the nose.	a. Ophthalmic nerve.
___ (2) Soft tissues of the floor of the mouth	b. Maxillary nerve.
___ (3) Roof of the mouth.	c. Mandibular nerve.
___ (4) Soft tissues of the tongue.	
___ (5) Maxillary incisors and cuspids.	
___ (6) The forehead.	
___ (7) Maxillary bicuspids.	
____(8) Gingiva, mucous membrane of the hard palate.	
___ (9) Inferior alveolar nerve.	
___ (10) Eyelids and eyebrows.	
___ (11) Anterior superior alveolar nerve.	
___ (12) Mental process.	
____(13) Uvula, tonsils, soft palate.	

50. For each passageway in Column A, identify the appropriate major division of the trigeminal nerve in Column B that the passageway serves. Items in column B may be used more than once. Mark your answers in the space provided.

	Column A	Column B
___ (1)	Floor of orbit of the eye.	a. Division I. Ophthalmic nerve)
___ (2)	Mental foramen.	b. Division II. (Maxillary nerve)
___ (3)	Greater palatine foramen.	c. Division III. (Mandibular nerve)
___ (4)	Lesser palatine foramina.	
___ (5)	Mandibular foramen.	
___ (6)	Incisive canal.	

51. As depicted in figure 2-14, which of the following arteries supplies blood to the jaws, the teeth, and their supporting structures?

a. Internal carotid.

b. External carotid.

c. Maxillary artery.

d. Lingual carotid.

e. Descending palatine artery.

52. Select the structure that is NOT supplied with blood by the external carotid artery.

a. Teeth and their supporting tissues.

b. Tongue.

c. Soft tissues of the side of the face.

d. Bones of the mandible.

e. Eyes.

53. According to the lesson, the dura mater has a channel within its two layers for the:

    a. Synovial membrane.

    b. Trigeminal nerve.

    c. Cavernous sinus.

    d. Venous blood from the brain.

    e. External carotid arteries.

54. As depicted in figure 2-16, which one of the following veins is joined directly with the covering of the brain?

    a. Infraorbital vein.

    b. Anterior facial vein.

    c. Posterior superior alveolar vein.

    d. Angular vein.

    e. Internal jugular vein.

55. Any infection in the maxillary anterior teeth is serious because the infection can travel into the:

    a. Cavernous sinus.

    b. Nasal sinus.

    c. Maxillary sinus.

    d. Sphenoid sinus.

    e. Rontal sinus.

56. List two principal uses of the tongue.

a. The _____ of _____.

b. _____ and _____ food.

57. The taste buds are most closely related to the:

a. Salivary glands.

b. Alveolar ridge.

c. Soft tissues of the mouth.

d. Papilla on the tongue.

e. Trigeminal nerve.

SPECIAL INSTRUCTIONS FOR EXERCISES 58 THROUGH 60. Match each salivary gland in Column A to its description in Column B. Mark your answers in the space provided.

	Column A		Column B
___ 58.	Parotid gland.	a.	Just below the mucous membrane in the floor of the mouth, beneath the lateral aspects of the tongue.
___ 59.	Submandibular gland.	b.	Located on each side of the face, just below and in front of the ear.
___ 60.	Sublingual gland.	c.	Located in the floor of the mouth, just forward of the angle of the jaw.

61. Which one of the following is the largest of the salivary glands?

a. Parotid.

b. Submandibular.

c. Sublingual.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 2

1. f (para 2-3a)
2. e (para 2-3b)
3. d (para 2-3c)
4. c (para 2-3d)
5. a (para 2-3e)
6. b (para 2-3f)
7. c (para 2-3b)
8. a (para 2-3b)
9. e (para 2-3f(2))
10. d (para 2-3f(1))
11. b (para 2-4)
12. e (para 2-3d, table 2-1)
13. a (para 2-4a)
14. c (para 2-3f(1))
15. d (para 2-3f)
16. b (para 2-3f(1)
17. c (para 2-3f(2))
18. a (para 2-3f(3)
19. a. Mandible.
    b. Maxillae.
    c. Zygomatic.
    d. Lacrimal.
    e. Nasal.
    f. Interior nasal conchae
    g. Palatine.
    h. Vomer. (table 2-1)

20. a. Jaws. (para 2-5)
    b. (1) Swallowing.
    (2) Seeing.
    (3) Breathing (para 2-4)
    c. Maxilla. (para 2-5)
    d. Mandible. (para 2-5)

21. b (para 2-6b)

22. a (para 2-6c)

23. d (para 2-6d)

24. c (para 2-6e)

25. c (para 2-6)

26. e (para 2-6e(1))

27. a. Teeth.
    b. Alveoli.
    c. Alveolus. (para 2-6d(1))

28. periodontal membrane; periodontal ligament (para 2-6d(1))

29. a (para 2-7)

30. e (paras 2-7a(1), b)

31. d (para 2-7a)

32. c (para 2-7b)

33. b (para 2-7b(4))

34. c (para 2-8a)

35. a (para 2-8b)

36. d (para 2-8c)

37. b (para 2-8d)

38. e (para 2-8e(1))

39. Digastric.
Mylohoid.
Geniohyoid.
Genioglossus. (para 2-8e(2))

40. e (para 2-8b; figure 2-9)

41. a (para 2-8e(2); figure 2-8)

42. d (para 2-7c)

43. a. Condyloid process.
b. Mandibular fossa. (para 2-9a)

44. a. Thin, biconcave, oval.
b. Fossa; condyle.
c. Synovial; lubricate.
d. Lateral pterygoid. (para 2-9b)

45. b (para 2-9c)

46. c (para 2-9b)

47. a. Nonadjustable.
b. Adjustable. (para 2-9e)

48. a. Twelve.
b. Fifth
c. Trigeminal.
d. Mastication.
e. Head; face. (para 2-10)

49. (1) a
(2) c
(3) b
(4) c
(5) b
(6) a
(7) b
(8) b
(9) c
(10) a
(11) b
(12) c
(13) b (para 2-10, fig 2-14)

50. (1) a
(2) c
(3) b
(4) b
(5) c
(6) b (para 2-10)

51. c (para 2-11a(3))

52. e (para 2-11a(1))

53. d (para 2-11b(1))

54. b (para 2-11b(2); figure 2-16)

55. a (para 2-11b(3))

56. a. Production; speech.
b. Masticating; swallowing. (para 2-12b)

57. d (para 2-12a)

58. b (para 2-13a)

59. c (para 2-12b)

60. a (para 2-13c)

61. a (para 2-13a)

End of Lesson 2

LESSON ASSIGNMENT

LESSON 3	Topography of the Mouth and Tooth Structure.
LESSON ASSIGNMENT	Paragraphs 3-1 through 3-9.
LESSON OBJECTIVES	After completing this lesson, you should be able to:
	3-1. Identify the two major divisions of the mouth.
	3-2. Identify the structures of the oral vestibule.
	3-3. Identify the structures of the oral cavity.
	3-4. Identify the parts of the teeth and the tissues of the teeth.
	3-5. Identify the alveolar process and its parts.
	3-6. Identify the periodontal ligament and the gingiva.
SUGGESTION	After studying the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 3

TOPOGRAPHY OF THE MOUTH AND TOOTH STRUCTURE

Section I. TOPOGRAPHY OF THE MOUTH

3-1. GENERAL

The mouth, which is the first subdivision of the digestive system, can be divided into two parts--the oral vestibule and the oral cavity. The oral vestibule is the space separating the lips and cheeks from the teeth and gums. The oral cavity is that part of the mouth which, in front, is bounded by the teeth and which, in back, opens to the throat. Topography of the mouth refers to the surface configuration of the mouth, that is, the figure, the contour, or the arrangement pattern of its parts.

3-2. ORAL VESTIBULE

The space between the front teeth and the lips forms the anterior part of the oral vestibule. The posterior part of the oral vestibule can be explored by clenching the teeth, pulling the lips apart, and pushing the index fingers back along the surface of the teeth, moving them as far up and down as possible. Figure 3-1 shows a cross-section of the mouth. One of the principal uses of the mouth is human speech. These specialized sounds are made by using the lips, the teeth, the bony ridge back of the upper teeth (the alveolar process), the hard and the soft palate, and the tongue. These features can be noted in the figure.

a. **Mucobuccal Folds.** The mucobuccal folds, which form the upper and lower boundaries of the vestibule, are important in the making of a denture. If the borders (edges) of a denture are too long in the mucobuccal fold area, the denture will not fit properly. It will cause inflammation and soreness of the tissues.

b. **Labial Frena.** Approximately in the midline of the mouth, there are sickle-shaped folds which connect the alveolar processes with the upper and lower lips and tend to restrict their movement. These folds may be examined by pulling the upper lip outward and upward and the lower lip outward and downward. These folds are called the upper and lower labial frena or frenula (singular--frenum or frenulum). Similar frena are found posteriorly, connecting the alveolar processes with the cheeks. They also must be considered in the making of a denture. If an inadequate groove is made in the denture to accommodate the frenum, then this delicate fold of tissue will not only be damaged by constant rubbing, but will also place a constant pull on the denture, which may be strong enough to dislodge it.

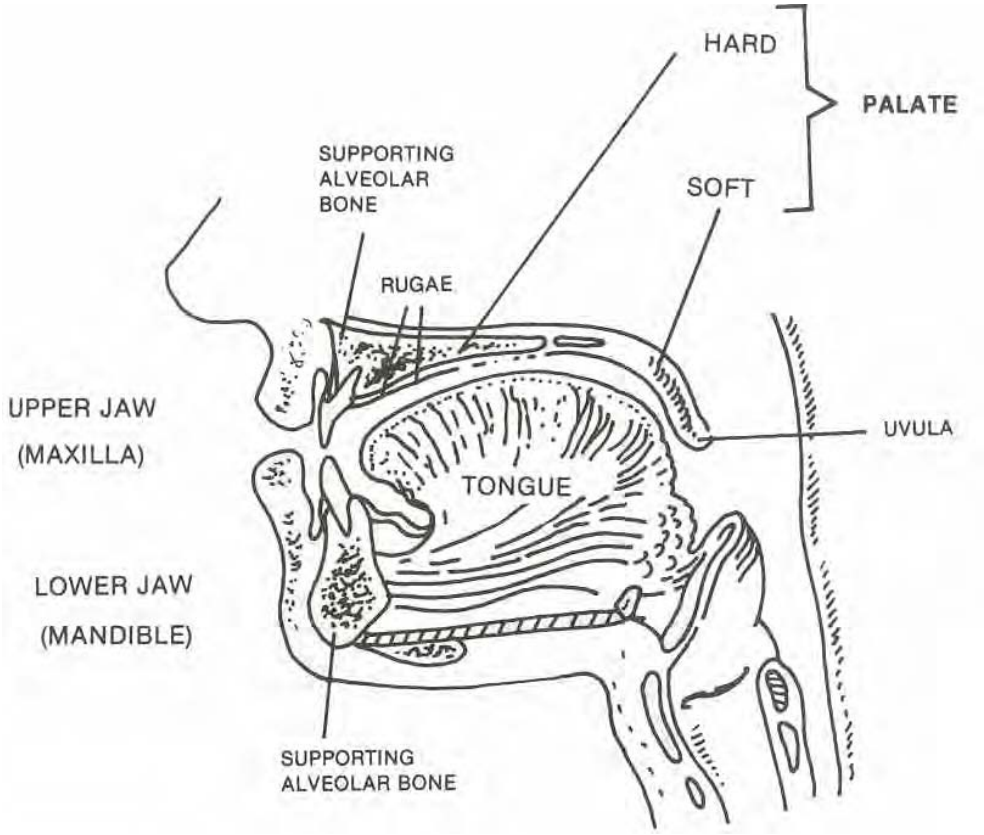

Figure 3-1. Cross-section of the mouth.

c. **Opening of the Parotid Gland.** The parotid gland, the largest of the salivary glands empties its contents (saliva) into the oral vestibule through an opening called Stensen's duct (which is another name for the parotid duct). See figure 2-17. The opening can be found opposite the crown of the maxillary second molar and is generally marked by a high elevation of mucous membrane, which is the parotid papilla.

d. **The Teeth.** When the mouth is open wide and the jaws are apart, the teeth can be seen to be arranged in arches with open ends directed backwards or posteriorly. The maxillary teeth are in the maxilla or upper jaw. See figure 3-2. The mandibular teeth are in the mandible or lower jaw. See figure 3-3. If an imaginary vertical line (the midline) is drawn between the central incisors and extended backward, it will cut each arch into two halves, one the mirror image of the other. Each of these parts is termed a quadrant. Thus, there is a maxillary right and a maxillary left quadrant and a mandibular right and a mandibular left quadrant. There are eight permanent teeth in each quadrant. Viewing each quadrant from the midline posteriorly, the two incisors (the central and lateral), one cuspid, two bicuspids (premolars), and three molars make up the arrangement of the teeth. The incisors and cuspids are known as the anterior teeth, and the bicuspids and molars as the posterior teeth.

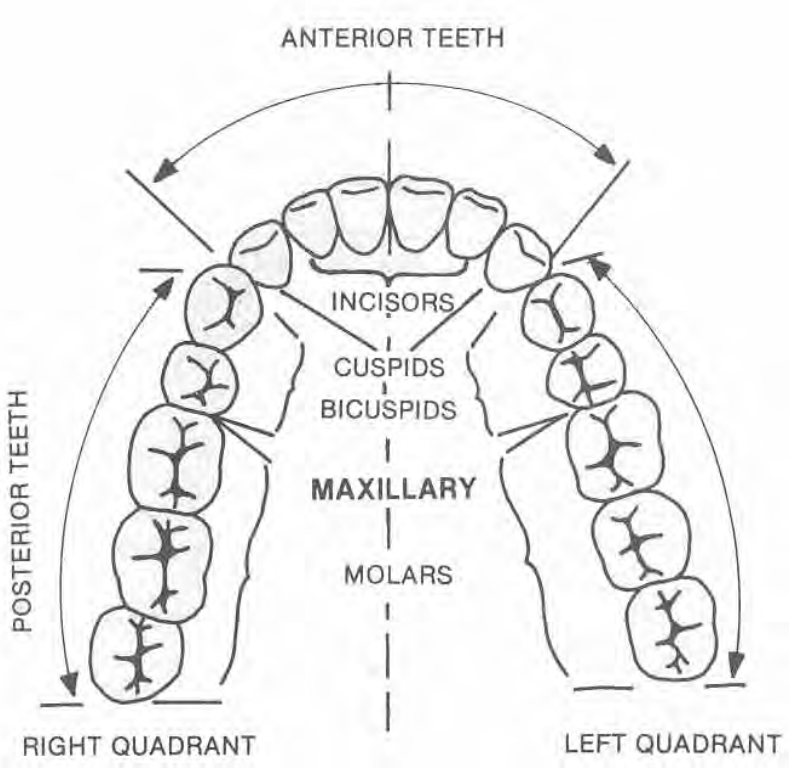

Figure 3-2. Maxillary teeth.

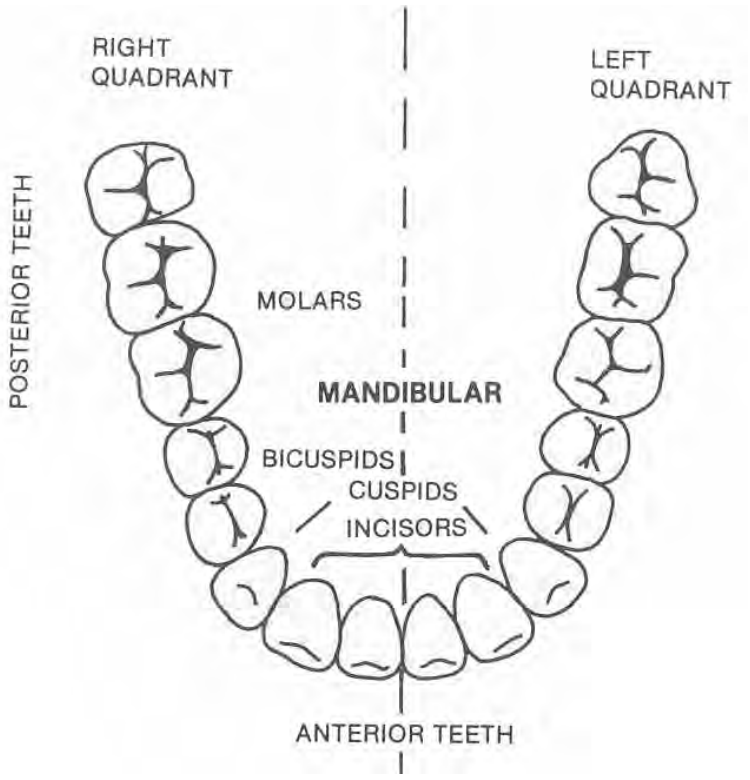

Figure 3-3. Mandibular teeth.

e. **Tooth Characteristics.** An individual tooth may be identified by its position; for example, maxillary left central incisor. It may also be identified by its anatomical form since each tooth has its own particular characteristics which set it apart from any other. Some teeth, for instance, have cutting or incisal edges (example: incisors), and others have cusps (cone-like projections of the crowns). Normally when the jaws are closed, the cusps interdigitate (interlock). The teeth are then said to be "in occlusion."

f. **A Small Space.** With the teeth in occlusion, there is a space distal to (posterior to) the most posterior molar. This space connects the vestibule with the oral cavity. It is useful to note that when a person's jaws are wired together, as with a fractured jaw, that liquefied food can be provided through this natural opening.

3-3. MUCOUS MEMBRANE

The mouth, nose, sinuses, eyelids, throat, and digestive tract are lined with mucous membrane. The mucous membrane lining the oral cavity is called oral mucosa. It covers the inside of the cheeks and lips and the bony process (alveolar process) in which the teeth are embedded. This covering of the alveolar process (which surrounds the necks of the teeth) is called the gingiva or gum tissue. Oral mucosa serves as a protective covering for the soft tissues of the mouth, much like skin protects outer surfaces of the body. Mucous membrane is a tissue similar in composition to the skin. It differs from skin mainly in having many mucous glands which bathe its surface. It is also softer and not as tough as skin. Normally, mucous membrane has a pink color. Healthy gingiva is pale coral pink and firm. In persons with darker skin, the gingiva may have dark pigmentation as well. When diseased, the mucous membrane may be bright red, indicating certain vitamin deficiencies, or it may be very pale pink, indicating anemia. The color of oral mucosa can aid in disease diagnosis.

3-4. THE ORAL CAVITY

The oral cavity is bounded in front (anteriorly) and on the sides (laterally) by the gingival and lingual surfaces of the teeth. It opens posteriorly into the pharynx, which is a funnel-shaped space joining the nose and mouth with the passages (trachea and esophagus), leading to the lungs and stomach.

a. **Roof of the Mouth.** The roof of the mouth is shaped like a vault (arched). It consists of the hard palate, anteriorly, and the soft palate, posteriorly, which together are called the palate. The hard palate is the hard part of the roof of the mouth, which makes up about two-thirds of the palatal area. It is covered with mucous membrane, which is closely adherent to the inferior surface of the maxilla. The maxillary bone gives the palate its vaulted form. The soft palate, the posterior one-third, is continuous with the hard palate. It has no bony foundation and consists of soft tissue, chiefly muscles, lined with mucous membrane. Its posterior border hangs free and has an arched shape. The soft palate is elevated during swallowing to completely separate the oral and nasal cavity.

(1) Rugae. The mucous membrane in the roof of the mouth forms ridges (or corrugations) called rugae. Rugae are elevated folds or wrinkles of fibrous soft tissue situated in the hard palate, just behind the maxillary anterior teeth. The rugae aid in the formation of speech sounds and also serve as secondary stress-bearing areas for dentures.

(2) Maxillary tuberosity. The maxillary alveolar ridge ends in a rounded prominence distal to the last tooth on each side. This prominence is called the maxillary tuberosity. It plays a part in the retention and stability of maxillary dentures.

(3) Hamular notch. Just distal to the maxillary tuberosity, in the posterior palate where the maxilla and sphenoid bone unite, is a notch called the hamular notch. The posterior border of a full upper denture is usually designed to fit into this area.

(4) Uvula. Hanging from the middle or highest point of the soft palate is the uvula (a fleshy and somewhat cone-shaped mass of tissue). See figure 3-1. The uvula plays a part in swallowing; in combination with certain muscles of the neck, it closes the passage between the nasal cavity and the throat. In this way, food is kept from entering the nasal cavity and, at the same time, air is prevented from being swallowed. The uvula also assists in speaking. It vibrates and gives resonance to the voice.

(5) Tonsils. On the concave walls of the soft palate are small masses of tissue. These are the tonsils. When inflamed, they are enlarged and reddened, a condition called tonsillitis.

b. **Floor of the Mouth.** The floor of the mouth is formed by the mylohyoid muscle.

(1) Lingual frenum. By pulling the tip of the tongue up and back, one can see a fold of tissue which connects the under surface of the tongue with the floor of the mouth. This is called the lingual frenum.

(2) Openings of submandibular salivary glands. These openings are on the floor of the mouth toward the anterior extremity of the lingual frenum. Two slight elevations can be seen, one on each side of the lingual frenum.

(3) Openings of sublingual salivary glands. These glands lie directly beneath the anterior part of the floor of the mouth. They open directly onto the floor of the mouth through many tiny indistinct openings.

c. **Tongue.** The tongue occupies most of the space within the mouth when it is closed. The tip of the tongue (the thin anterior part) is freely movable. The body is connected to the sides of the mandible and is also movable, but to a more limited extent. The posterior part has a broad muscular attachment both to the hyoid bone and to the mandible. The tongue is the principal organ for the sense of taste and the production of speech. It aids in masticating (chewing, grinding) and swallowing food.

Section II. TOOTH STRUCTURE

3-5. PARTS OF TEETH

a. **Crown.** Each tooth is divided into the crown and the root (or roots) (see figure 3-4). The crown is that part of the tooth which is covered by enamel. The term clinical crown is often used to refer to that part of the tooth which is visible in the mouth. It seldom conforms exactly to that part covered by enamel. In this subcourse, the term crown will refer to the anatomic crown or that portion of the tooth actually covered by enamel. That portion of the tooth where the crown and the root join is commonly called the cervix (neck) of the tooth. The junction between the enamel of the crown and cementum of the root is called the cementoenamel junction (CEJ) or cervical line.

b**. Root.** The root (or roots) is that part of the tooth which is covered by cementum. It is mostly embedded in the bony process of the jaw. The tip (or end) of the root is called the apex. A small opening which passes though the apex is called the apical foramen. Through this opening, the blood vessels and nerves pass to and from the dental pulp. Often, there are additional small openings near the root apex called supplementary foramina.

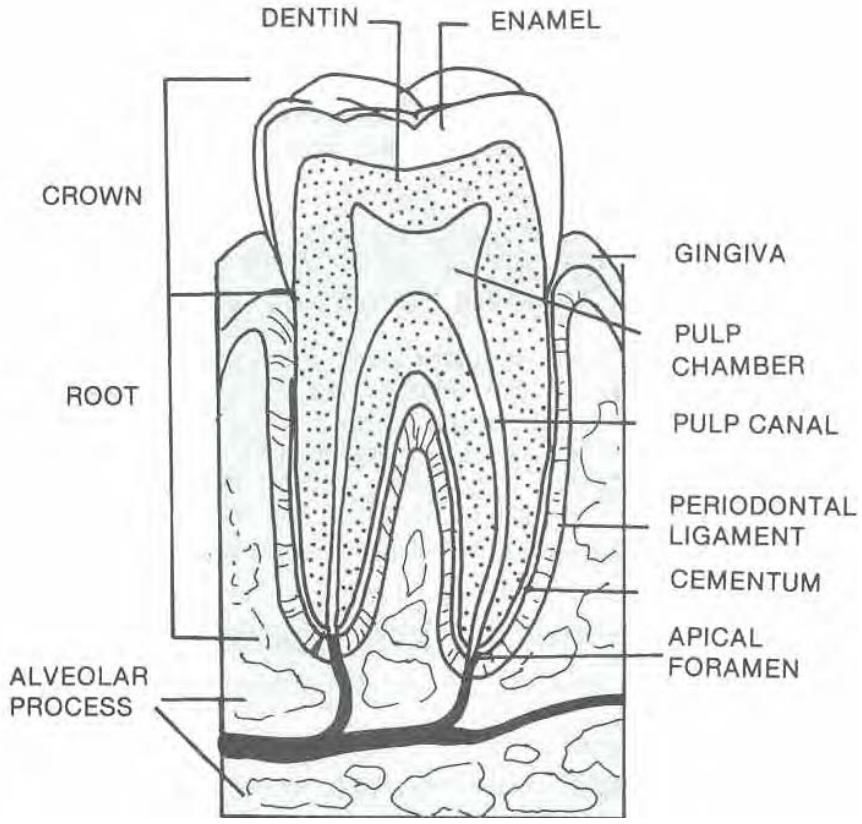

Figure 3-4. The tooth and supporting structures.

c. **Gingival Tissue and the Crown.** In young persons, part of the enamel of a tooth is normally covered by gingival (gum) tissue. Only the clinical crown is exposed. On older persons, it is common for the tooth's enamel to be completely exposed above the gingiva (the anatomical crown) and even to have part of the root surface showing.

3-6. TISSUES OF THE TEETH

a. **Enamel.** Enamel is the calcified substance that covers the entire crown of the tooth. It consists of approximately 96 percent inorganic (nonliving) material and it is the hardest tissue in the human body. Enamel is thickest at the top of the teeth (at the cusps), thinning to a knife edge thickness where the crown and root join (the cervical line). Enamel is formed only once and cannot regenerate or repair itself. Thus, when enamel is destroyed by decay, operative dentistry is required to reconstruct the tooth. Enamel has no nerve fibers and cannot register sensations. It is strong and hard. It has the ability to withstand the stress of mastication and does not wear away easily. It is thick in areas that contact opposing teeth. Enamel serves to protect the underlying softer dentin. The color of a tooth is derived from the enamel, which is usually shaded from light yellow to white.

b. **Dentin.** The bulk of the tooth is made up of a calcified tissue called dentin. Dentin is a light yellow substance that is softer than enamel but harder than bone. It consists of approximately 65 percent inorganic matter. It is slightly elastic and compressible. Dentin is found inside the crown under the enamel. Dentin is also found inside the root of the tooth under the cementum. The inner surface of the dentin forms a hard-walled cavity that contains and protects the pulp. Unlike enamel, dentin continues to form throughout the life of the tooth.

c. **Cementum.** Cementum forms a protective layer over the root portion of the dentin. It consists of 50 percent inorganic material and is a bonelike substance, although it is not as hard as bone. The cementum joins the enamel at the cervix (neck) of the tooth. The point at which they join is called the cementoenamel junction. The main function of cementum is to anchor the tooth to the socket by providing attachment for the principal fibers of the periodontal ligament. Cementum is formed continuously throughout the life of the tooth.

d. **Pulp.** The pulp is the soft tissue that fills the pulp cavity. This tissue contains numerous blood vessels and nerves which enter the tooth through the apical foramen. The pulp is enclosed within the hard, unyielding dentin walls of the pulp cavity. The pulp cavity has two parts: the pulp chamber and the root canal (or pulp canal). The pulp chamber is located inside the crown. The root canal (or pulp canal) is located inside the root. An important function of the pulp is the formation of dentin. Pulp responds to external stimuli, providing sensation to the tooth. Any inflammatory swelling of the pulp tissue will compress the blood vessels against the walls. This condition can lead to death of the pulp tissue.

3-7. ALVEOLAR PROCESS

The alveolar process is that part of the mandible and maxilla which supports the teeth. It is the bone that forms the tooth sockets and surrounds the teeth. See figure 3-4. It fulfills the functional demand of supporting the teeth, but it partially disappears when the teeth are lost and the functional demand ceases to exist. The structure of the alveolar process is basically the same as that of other bone tissue. Because of variations in its structural arrangement, however, the alveolar process may be divided into three parts for descriptive purposes. These parts are called the cortical plate, the spongiosa, and the lamina dura.

a. **The Cortical Plate.** The cortical plate is the hard, dense, outer surface of the bone. The bone is the alveolar process. It varies in thickness and is generally thicker on the tooth surfaces facing the tongue and the palate.

b. **The Spongiosa.** The spongiosa is a type of bone which is softer and more sponge-like than ordinary bone. It occupies the space between the inner and outer cortical plates. The spongiosa is also called cancellous bone because of the lattice-like structure of the bony tissue. This structure makes up the central mass of the alveolar process.

c**. The Lamina Dura.** The lamina dura is a thin layer of cortical bone that lines the tooth socket. It is connected to the tooth by the periodontal ligament. The lamina dura has many sieve-like openings which pierce it and provide passage for blood vessels and nerves that communicate with the periodontal ligament.

3-8. PERIODONTAL LIGAMENT

The periodontal ligament is a thin, fibrous ligament connecting a tooth to the lamina dura of the bony socket. Normally, teeth do not contact bone directly. A tooth is suspended in its socket by the fibers of the ligament. Because of this arrangement, each tooth is capable of limited individual movement. The fibers act as shock absorbers to cushion the force of chewing impacts. The periodontal ligament also supplies nutrition to the alveolar process. It supports and attaches the gingiva. It registers sensations of heat, cold, pressure, pain, and touch. In dental radiographs, the ligament appears as a thin, dark line around the root. The lamina dura, in contrast, appears as a thin, white line around the ligament.

3-9. GINGIVA

The gingiva is the soft tissue that covers the alveolar process and surrounds the neck of the teeth. The gingiva consists of an outer layer of epithelium and an inner layer of connective tissue. The gingiva is described as being free or attached. The free gingiva is that portion of the gingiva surrounding the neck of the tooth just above the cervix, not directly attached to the tooth, and forming the soft tissue wall of the gingival sulcus. The gingival sulcus is the V-shaped space between the free gingiva and the tooth. A healthy gingival sulcus extends to a depth of approximately 2 mm, at which point the gingiva is attached to the tooth by the epithelial attachment. See figure 3-5. The interdental papilla is the portion of the gingiva that fills the interproximal space between two adjacent teeth. A healthy gingiva is pink, firm, and resilient. Healthy gingiva is pale, coral pink and firm. When inflamed, the gingiva may become sore and swollen, and it may bleed.

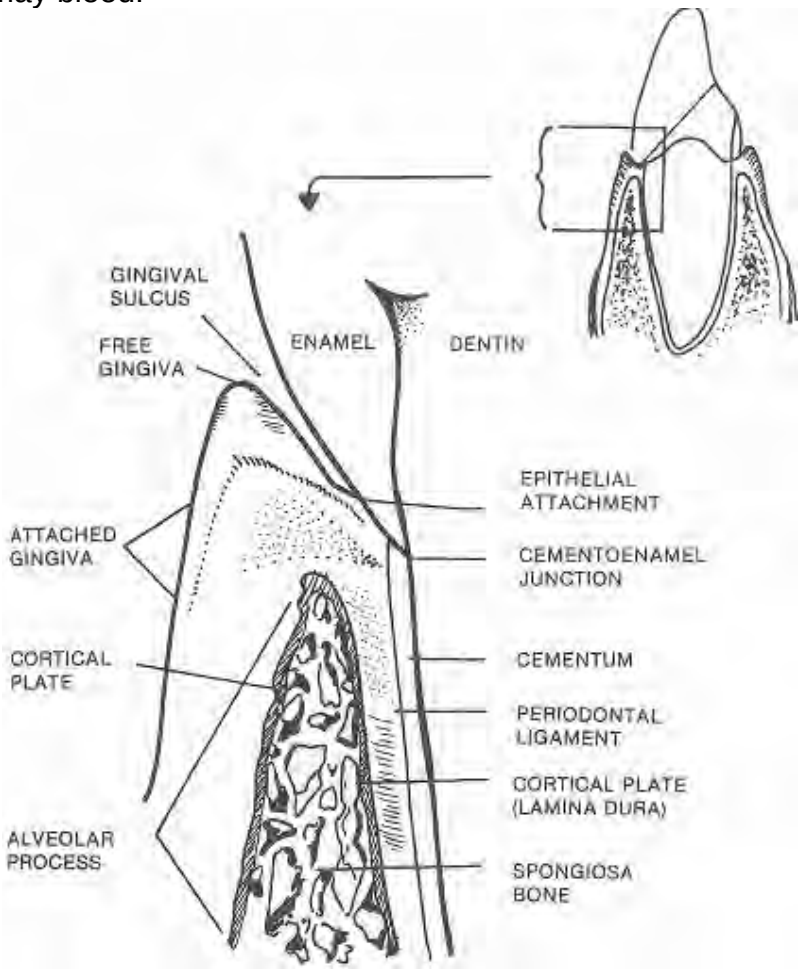

Figure 3-5. Close-up view of the gingiva and tooth structures.

Continue with Exercises

EXERCISES, LESSON 3

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the question, or by completing the incomplete statement, or by writing the answer in the space provided at the end of the question.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson, and check your answers. For each exercise answered incorrectly, reread the material referenced after the answer.

1. What is the meaning of topography of the mouth?

   a. Anatomy of the mouth.

   b. Pattern of arrangement of parts of the mouth.

   c. Surface configuration of the mouth.

   d. Both b and c above.

2. If a person clenches his teeth and inserts the index finger into the mouth, moving the finger upwards and downwards as far as the tissue of the cheeks and lips will comfortably permit, the person will be exploring the:

   a. Mouth.

   b. The vestibule of the mouth.

   c. The gingiva.

   d. The gums.

3. The mouth is the first subdivision of the digestive system and has two parts, one of which is the oral vestibule. The vestibule is the space that:

   a. Includes the tongue and is lingual to the teeth.

   b. Is posterior to the teeth.

   c. Lies between the lips, cheeks, and teeth.

   d. Includes the palate and the pharynx.

4. The sickle-shaped folds which connect the alveolar processes with the upper or lower lips comprise the:

    a. Labial frena.

    b. Lingual frenum.

    c. Mucobuccal folds.

5. The tissues which form the upper and lower boundaries of the oral vestibule comprise the:

    a. Labial frena.

    b. Lingual frenum.

    c. Mucobuccal folds.

6. Which salivary gland has an opening that is easily noted because of a high elevation of mucous membrane?

    a. Submandibular.

    b. Parotid.

    c. Sublingual.

7. What two areas of the vestibule of the mouth are of great importance in denture construction?

    a. Gingiva of the maxilla and the mandible.

    b. Openings of the parotid glands.

    c. Spaces most distal to the posterior molars.

    d. Mucobuccal folds and labial frena.

8. Normally each of the four quadrants of the maxillary and mandibular arches contains:

    a. 2 molars, 3 bicuspids, 2 cuspids, and 2 incisors.

    b. 2 molars, 2 bicuspids, 2 cuspids, and 2 incisors.

    c. 3 molars, 2 bicuspids, 1 cuspid, and 2 incisors.

    d. 3 molars, 1 premolar, 2 cuspids, and 3 incisors.

9. Incisors and cuspids are known as:

    a. Anterior teeth.

    b. Posterior teeth.

10. Bicuspids and molars are known as:

    a. Anterior teeth.

    b. Posterior teeth.

11. Cutting edges are found on:

    a. Cuspids.

    b. Bicuspids.

    c. Molars.

    d. Incisors.

12. Conelike projections of the crowns are:

    a. Incisal edges.

    b. Cusps.

13. When cusps interdigitate, teeth are _____.

14. How would you orally feed a patient whose jaws are wired together for the purpose of splinting a fractured jaw?

    a. By introducing liquefied food through the hamular notch.

    b. By introducing liquefied food through the space between the anterior teeth.

    c. By introducing liquefied food through a space distal to the most posterior molar.

    d. By introducing liquefied food through the nostrils.

15. Oral mucosa is a tissue similar in composition to the skin, but it differs mainly in what one respect?

    a. There are mucous glands which bathe its surface.

    b. It resists infection better than skin.

    c. It is tougher than skin.

    d. It has less resistance to tumor development than skin.

16. Mucous membrane which covers the alveolar process is called:

    a. Mucous glands.

    b. Labial frena.

    c. Mucobuccal folds.

    d. Gingiva.

17. The color of normal mucous membrane is:

    a. White.

    b. Pale pink.

    c. Pink.

    d. Bright red.

18. Healthy gingiva is firm with a _____ color.

    a. White.

    b. Bright red.

    c. Pink.

    d. Pale coral pink.

19. Mucous membrane lines the oral cavity. A bright red mucous membrane may indicate:

    a. A normal condition.

    b. A vitamin deficiency.

    c. Anemia.

20. About what is the relative size of the hard palate as compared to the soft palate?

    a. The same size.

    b. Three times as large.

    c. Twice as large.

    d. Relative sizes vary greatly in individuals.

21. Which of the following are most closely associated with the roof of the mouth?

    a. Palate, hamular notch, and rugae.

    b. Palate, lingual frenum, and rugae.

    c. Palate, submandibular salivary glands, and uvula.

    d. Palate, maxillary tuberosity, and sublingual salivary glands.

    e. Palate, labial frena, and mucobuccal folds.

22. All of the following, EXCEPT the _____, are parts of the roof of the mouth.

    a. Tonsils.

    b. Uvula.

    c. Maxillary tuberosity.

    d. Rugae.

    e. Lingual frenum.

23. According to the text, where is the uvula located?

    a. On the maxillary tuberosity.

    b. At the junction of the maxilla and the sphenoid bone.

    c. Between the pharynx and the nasal cavity.

    d. At the highest point of the soft palate.

24. When a person swallows, what is (are) the function(s) of the uvula?

    a. Keeps food from entering the nasal cavity.

    b. Prevents air from being swallowed.

    c. Stabilizes dentures.

    d. a, b, and c above.

    e. a and b above.

25. Which of the following plays a part in the retention and stability of maxillary dentures?

    a. Rugae.

    b. Mucobuccal folds.

    c. Maxillary tuberosity.

    d. Hamular notch.

26. Small masses of tissue on the concave walls of the soft palate are the:

    a. Uvula.

    b. Tonsils.

    c. Rugae.

    d. Gingiva.

    e. Frena.

27. The rugae are elevated folds of mucous membrane, which are part of the:

    a. Hard palate.

    b. Soft palate.

28. Functions of the tongue are related to all of the following EXCEPT:

    a. Mastication of food.

    b. Swallowing of food.

    c. Taste.

    d. Breathing.

    e. Speech.

29. The part of the tooth covered by enamel is the:

    a. Crown.

    b. Root.

30. The part of the tooth covered by cementum is the:

    a. Crown.

    b. Root.

31. In older persons, the _____ is more likely to be completely exposed.

    a. Anatomic crown.

    b. Clinical crown.

32. Enamel has a knife edge thickness at the:

    a. Lamina dura.

    b. Dentin.

    c. Cusp.

    d. Cervical line.

33. Dentin has _____ percent inorganic matter.

    a. 96.

    b. 50.

    c. 65.

34. Dentin is situated under the:

    a. Enamel.

    b. Cementum.

    c. Cervix.

    d. Both "a" and "b" above.

35. Which of the following forms a hard-walled cavity that contains the pulp? The:

    a. Cementum.

    b. Enamel.

    c. Dentin.

36. Which of the following anchors the tooth to the socket? The:

    a. Cementum.

    b. Dentin.

    c. Enamel.

    d. Pulp.

37. List the two parts of the pulp cavity.

    a. The _____ _____.

    b. The _____ _____.

38. The alveolar process consists of:

a. A cortical plate.

b. Spongy bone.

c. Cancellous bone.

d. All of the above.

39. The alveolar process:

a. Is bony.

b. Supports the teeth.

c. Partially disappears when teeth are lost.

d. Is a connective tissue.

e. Items a, b, and c above.

40. Match the term related to the alveolar process in Column II to the description or term in Column I. Items in Column II may be used more than once. Write your answer in the space provided.

COLUMN I			COLUMN II
____	(1)	Cancellous bone.	a. Cortical plate.
____	(2)	Hard, dense outer surface.	b. Spongiosa.
____	(3)	Bone with sieve-like openings.	
____	(4)	Thinner on tooth surfaces away from the tongue.	c. Lamina dura.
____	(5)	Sponge-like bone.	
____	(6)	Connected to the teeth by the periodontal ligament.	

41. The bone that lines each tooth socket is the:

    a. Periodontal ligament.

    b. Lamina dura.

    c. Cortical plate.

    d. Spongiosa.

42. The structure that makes up the central mass of the alveolar process is the:

    a. Periodontal ligament.

    b. Cortical plate.

    c. Rugae.

    d. Lamina dura.

    e. Spongiosa.

43. The periodontal ligament:

    a. Is fibrous.

    b. Supports the teeth.

    c. Is bony.

    d. Both a and b.

44. In dental radiographs, the periodontal ligament appears as a thin _____ line around the root of a tooth.

    a. White.

    b. Dark.

45. Which one of the following is just above the cervix and forms the soft tissue wall of the gingival sulcus?

    a. Free gingiva.

    b. Attached gingiva.

    c. Interdental papilla.

46. The normal gingival sulcus extends to a depth of _____.

47. The portion of the gingiva that fills the interproximal space between two adjacent teeth is called the:

    a. Free gingiva.

    b. Gingival sulcus.

    c. Interdental papilla.

    d. Epithelial attachment.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 3

1. d (para 3-1)
2. b (para 3-2)
3. c (para 3-2)
4. a (para 3-2b)
5. c (para 3-2a)
6. b (para 3-2c)
7. d (para 3-2a, b)
8. c (para 3-2d)
9. a (para 3-2d)
10. b (para 3-2d)
11. d (para 3-2e)
12. b (para 3-2e)
13. in occlusion (para 3-2e)
14. c (para 3-2f)
15. a (para 3-3)
16. d (para 3-3)
17. c (para 3-3)
18. d (para 3-3)
19. b (para 3-3)
20. c (para 3-4a)
21. a (para 3-4a)
22. e (para 3-4a)

23. d (para 3-4a(4))

24. e (para 3-4a(4))

25. c (para 3-4a(2))

26. b (para 3-4a(5))

27. a (para 3-4a(1))

28. d (para 3-4c)

29. a (para 3-5a)

30. b (para 3-5b)

31. a (para 3-5c)

32. d (para 3-6a)

33. c (para 3-6b)

34. d (para 3-6b)

35. c (para 3-6b)

36. a (para 3-6c)

37. pulp chamber.
root canal or pulp canal. (para 3-6d)

38. d (para 3-7)

39. e (para 3-7)

40. (1) b
(2) a
(3) c
(4) a
(5) b
(6) c (para 3-7)

41. b (para 3-7c)

42. e (para 3-7b)

43. d (para 3-8)

44. b (para 3-8)

45. a (para 3-9)

46. 2 mm. (para 3-9)

47. c (para 3-9)

End of Lesson 3

LESSON ASSIGNMENT

LESSON 4	Dental Anatomy.
LESSON ASSIGNMENT	Paragraphs 4-1 through 4-25.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

4-1. Identify the differences between groups of teeth.

4-2. Identify the number and characteristics of deciduous teeth.

4-3. Identify the permanent teeth according to the military numbering system.

4-4. Identify the terminology related to the surfaces of teeth.

4-5. Identify the division of teeth into thirds.

4-6. Identify basic anatomic terminology that describes the location, configuration, or shape of teeth.

4-7. Identify the correct description of the anatomy of each permanent maxillary tooth.

4-8. Identify the correct description of the anatomy of each permanent mandibular tooth.

SUGGESTION After studying the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 4

DENTAL ANATOMY

Section I. ASPECTS OF THE ANATOMIC DESCRIPTION OF TEETH

4-1. GENERAL

Teeth are of different shapes and sizes. The primary function of teeth is to chew (masticate) food. They function in specialized ways in the preparation of food for digestion. There are two kinds of teeth--anterior and posterior. The anterior teeth are designed for the purpose of cutting and tearing food. The posterior teeth are designed for the purpose of grinding or crushing food. Teeth also have a role in speaking, by aiding in the production of sounds. Another function of teeth concerns appearance (esthetics). The presence or absence of teeth, their regularity or irregularity of position, and their color and condition greatly affect the appearance of the individual. The shape, size, number, and arrangement of teeth in a normal arch are such that they efficiently perform these major functions. The character and general arrangement of teeth, taken as a whole, are referred to as the dentition. The individual has two sets of teeth during his lifetime. The first set is the primary (deciduous or temporary) set of 20 teeth. A later set is the secondary (permanent) set of 32 teeth.

4-2. ANATOMIC DIFFERENCES BETWEEN GROUPS OF TEETH

The 32 teeth that are commonly found in the adult dentition have differences and similarities in form and function. For comparison, the teeth are often grouped as maxillary and mandibular teeth or as anterior and posterior teeth.

a. **Maxillary and Mandibular Teeth.** The maxilla and the mandible contain the same number and types of teeth. There are certain distinct differences between the teeth of the two jaws. One of the differences is in the mesiodistal width between the maxillary and mandibular anterior teeth. The normal relationship between the maxillary and mandibular teeth results in a horizontal and vertical overlap. The horizontal overlap is called overjet. The vertical overlap is called overbite. This results in a wider arch for the maxillary teeth to fill. It affects the anterior teeth because of the greater curvature of the anterior part of the dental arch. (There is little or no lateral curvature in the posterior part.) Other differences include the number of roots of molars (maxillary molars have three and mandibular molars have two), the configuration and the outline form of occlusal surfaces, and the nature of the curvature of vertical crown surfaces.

b. **Anterior and Posterior Teeth.** As indicated in paragraph 4-1, teeth may be divided into anterior and posterior groups. Anterior teeth, commonly called "anteriors" when referred to as a group, include the central and lateral incisors and the cuspids. Posterior teeth, commonly called "posteriors" when referred to as a group, include the bicuspids and molars. Anterior teeth differ from posterior teeth in their relative position within the dental arch. They also differ in their form, their function, and their conformity to that part of the arch in which they are located.

(1) Anterior teeth. Anterior teeth are characterized by having single roots and incisal edges or single-cusped crowns ending in narrow edges. These narrow edges are designed to incise (bite off) relatively large amounts of food in eating. Anterior teeth are located in the anterior part of the jaw. They are so aligned as to form a smooth curving arch from the distal of the cuspid of one side of the arch to the distal of the cuspid on the opposite side.

(2) Posterior teeth. Posterior teeth differ from anterior teeth in that they may have more than one root. They also differ in their form and function. They may also have multiple cusps forming occlusal surfaces designed to crush and grind food into small parts.

(a) Bicuspids. Most bicuspids have single roots but may have roots which are partly or completely bifurcated (over one-half of all maxillary first bicuspids have such bifurcations). As their name implies, most bicuspids have two cusps. The mandibular second bicuspid may have either two or three cusps. The three-cusped bicuspid has two lingual cusps and one buccal cusp.

(b) Molars. Molars are all multirooted (three roots in the maxillary arch and two roots in the mandibular arch). See figure 4-1. Molars have four or more cusps. First permanent mandibular molars have five functional cusps. The maxillary first molars have four functional cusps and the cusp of Carabelli, a nonfunctional cusp located on the mesioloingual surface. Third molars are commonly called "wisdom teeth." They resemble second molars but are largely unpredictable as to form, size, and number of roots.

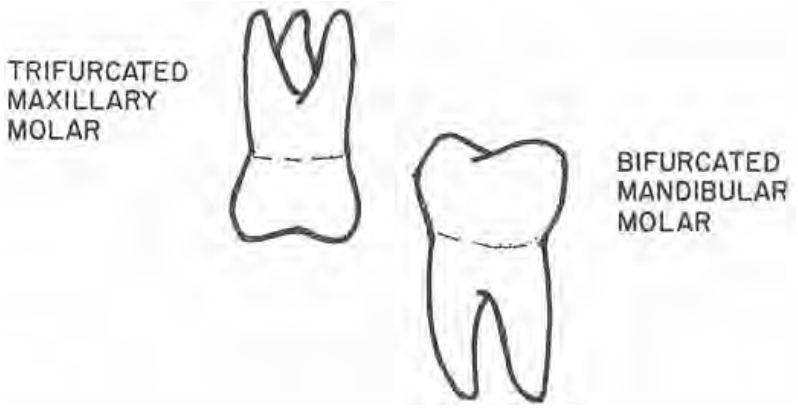

Figure 4-1. Trifurcated and bifurcated roots.

4-3. DECIDUOUS TEETH

The "deciduous dentition" is the common term used to designate the first set of teeth.

a. **Temporary Teeth or Primary Teeth.** The terms "temporary teeth" or "primary teeth" are often used because these teeth are replaced by a permanent or second set early in life. The deciduous teeth are also called "baby" or "milk" teeth. The first of the deciduous teeth push through the gums (erupt) at an average age of 6 months. All deciduous teeth are usually erupted by the end of the second year.

b. **Description of the 20 Deciduous Teeth.** There are 20 deciduous teeth, 10 in each jaw. In each half of each jaw, beginning at the midline and extending backward, these teeth are called: central incisor, lateral incisor, cuspid, first molar, and second molar. See figure 4-2. The name for each tooth is made more specific by the addition of terms indicating its location within the mouth, such as maxillary (upper) left central incisor or mandibular (lower) right cuspid. Thus, there are four of each type of tooth. Each is individually designated as maxillary or mandibular and as right or left.

c. **Permanent Tooth Formation and Temporary Tooth Resorption.** During the period of deciduous dentition, the permanent teeth are in the process of formation within the jaw. In the course of development, the roots of the temporary teeth undergo resorption (gradually dissolve) until there is insufficient remaining root structure to support them. During the period from about 6 to 12 years of age, the temporary teeth thus loosen and are lost. Temporary teeth are replaced by permanent teeth in a physiologically controlled sequence.

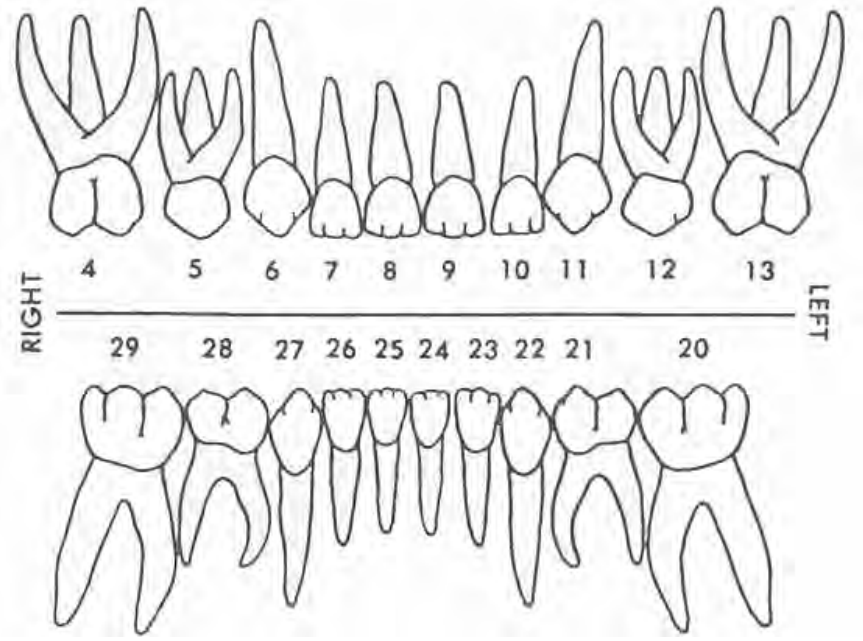

Figure 4-2. Deciduous teeth.

4-4. REPLACEMENT OF DECIDUOUS TEETH

a. **Replacement Teeth.** The 10 deciduous teeth of each jaw are replaced by the 10 most anterior teeth of the permanent dentition (see figure 4-3) as follows:

(1) The permanent central incisors replace the deciduous central incisors.

(2) The permanent lateral incisors replace the deciduous lateral incisors.

(3) The permanent cuspids replace the deciduous cuspids.

(4) The permanent first bicuspids replace the deciduous first molars.

(5) The permanent second bicuspids replace the deciduous second molars.

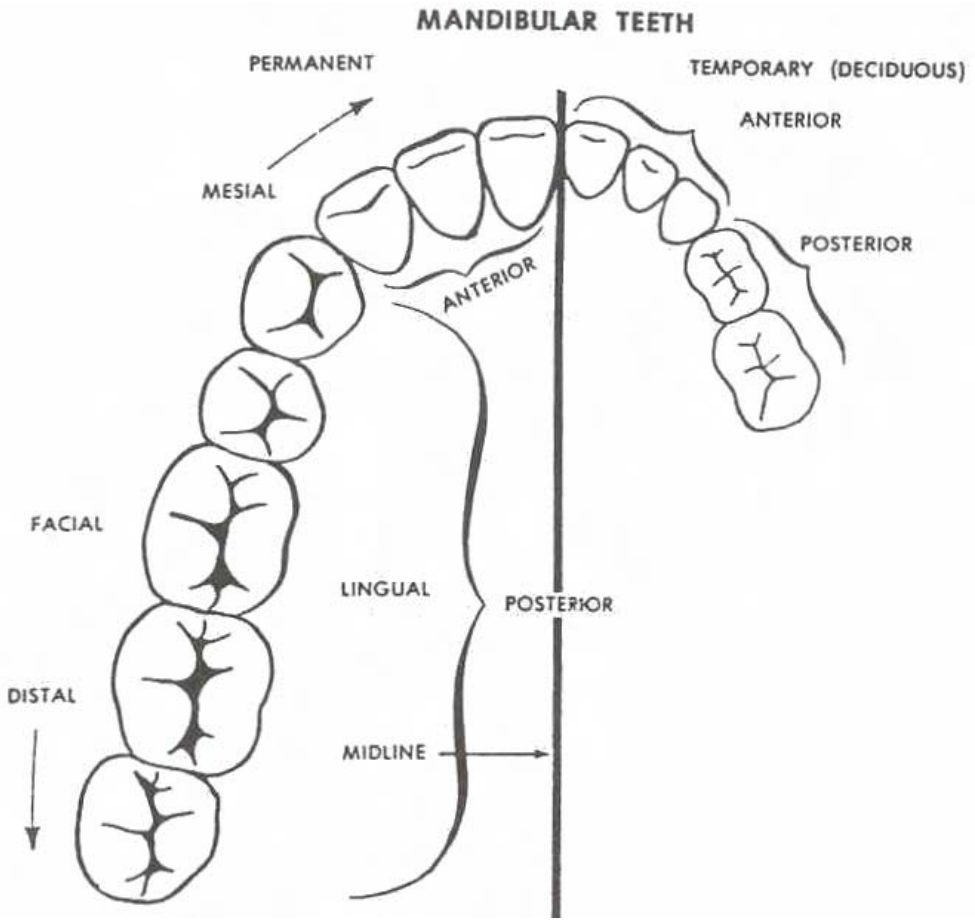

Figure 4-3. A comparison between the deciduous and permanent dental arches.

b. **Molars.** The three permanent molars on each side of the upper and lower jaw pierce the gum (erupt) distally to (behind) the deciduous second molars. Normally, at 6 or 7 years of age, the first permanent teeth to erupt are the first molars or the central incisors. Since the deciduous teeth are still in place when the first permanent molars erupt, the latter are often overlooked or mistaken for temporary teeth. Because the molars contain many pits and fissures, they are prone to decay. If they are neglected, they are often lost too early in life.

4-5. PERMANENT TEETH

There are 32 permanent teeth, 16 in the maxilla and 16 in the mandible (see figure 4-4). The permanent teeth on the right side of the mouth, for example, are named as follows:

a. Maxillary right central incisor and mandibular right central incisor.

b. Maxillary right lateral incisor and mandibular right lateral incisor.

c. Maxillary right cuspid and mandibular right cuspid.

d. Maxillary right first bicuspid and mandibular right first bicuspid.

e. Maxillary right second bicuspid and mandibular right second bicuspid.

f. Maxillary right first molar and mandibular right first molar.

g. Maxillary right second molar and mandibular right second molar.

h. Maxillary right third molar and mandibular right third molar.

4-6. NUMBERING OF TEETH

Several systems of numbering the teeth have been devised to simplify the designation of a tooth by an authorized number rather than by name. The system used by the armed services (see figure 4-4) begins with the maxillary right third molar and numbers around the maxillary arch from 1 to 16. It continues with the mandibular left third molar as No. 17 and goes around the lower arch from 17 to 32. By this method, the number alone designates the tooth without the use of letters "R" and "L". For example, tooth No. 3 is the maxillary right first molar and No. 24 is the mandibular left central incisor. In dental records and general correspondence, the dental specialist refers to a tooth by authorized number rather than by name.

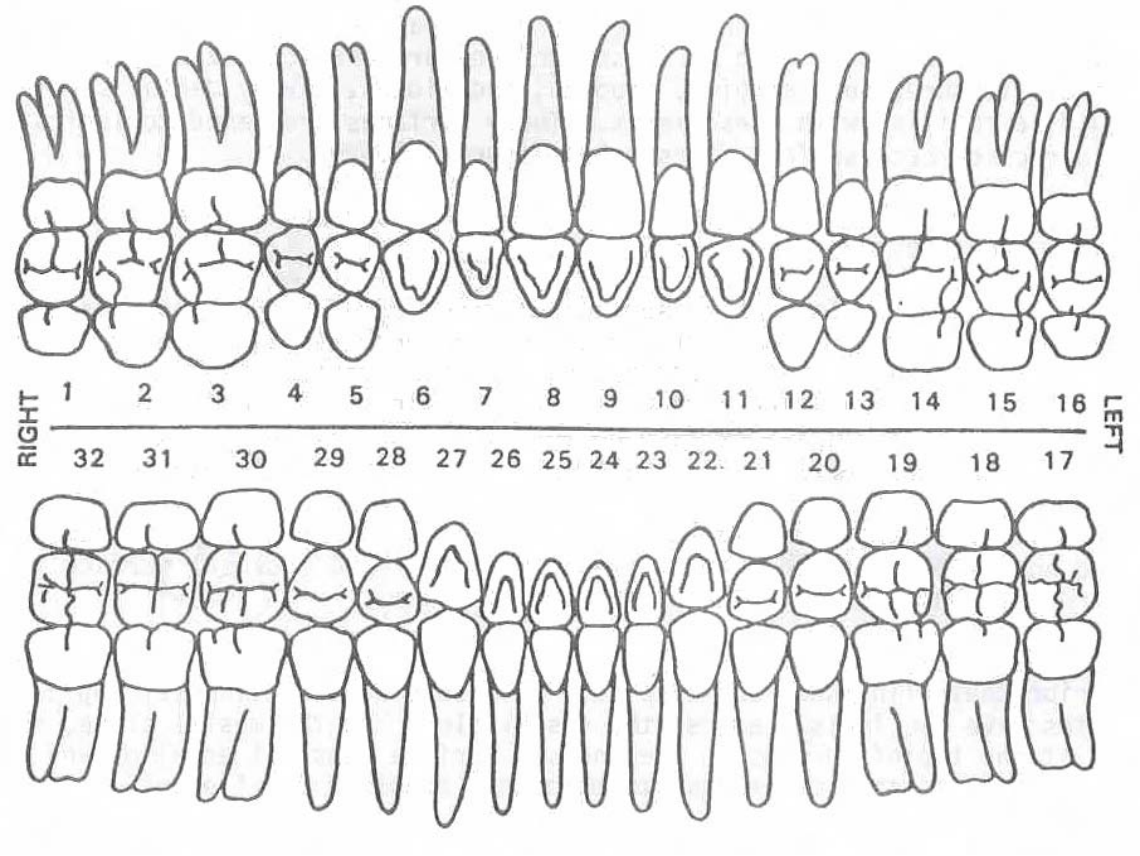

Figure 4-4. Permanent teeth; numbers of the teeth.

4-7. SURFACES OF TEETH

For convenience of description and as an aid in denoting the location of areas of decay and restorations, the crown part of a tooth is divided into a number of surfaces. Some of these surfaces are characterized by certain anatomic features such as pits, grooves, and ridges. Every dental specialist should be familiar with these terms. These surfaces are named to indicate the direction each surface faces. See figure 4-5.

a. **Lingual.** The lingual surface is that surface of the tooth that faces toward the tongue.

b. **Facial.** The facial surface of a posterior (back) tooth faces toward the cheek. In some textbooks, it is referred to as the buccal surface because it lies next to the buccinator (cheek muscle). The facial surface of an anterior (front) tooth faces toward the lips. In some textbooks, it is referred to as the labial surface because it lies next to the labia (lips). In this subcourse, the term facial surface will be used.

c. **Occlusal.** The occlusal surface is the broad chewing surface found on posterior teeth (bicuspids and molars). The occlusal surface faces toward and contacts the teeth of the opposite jaw.

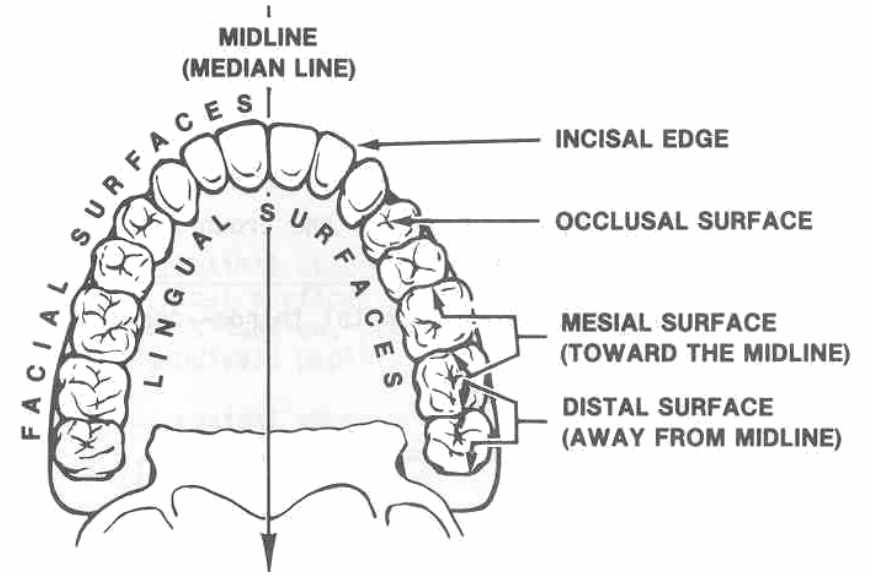

Figure 4-5. Occlusal view of maxillary tooth surfaces.

d. **Incisal.** The incisal surface is the narrow cutting edge found on anterior teeth (incisors and cuspids). Incisors have one incisal edge. Cuspids have two incisal edges, the distal slope and the mesial slope, that meet at the tip of the cusp. The incisal surface (incisal edge) of an anterior tooth faces toward the teeth of the opposite jaw.

e. **Proximal.** The proximal surface lies next to another tooth. The tooth surfaces that face each other are called proximal surfaces. The proximal surface includes the entire length of the tooth from the crown to the root tip. Most mesial and distal surfaces are proximal surfaces.

f. **Mesial.** The mesial surface (toward the midline) contacts the tooth immediately anterior to it (mesial to it) in the dental arch. Following the curvature of the dental arch, it is the surface of a tooth that is closest to or facing the midline (or median line) of the arch. With central incisors, it is that surface which normally contacts the central incisor of the opposite side of the arch.

g. **Distal.** The distal surface (away from the midline) contacts the tooth immediately posterior to it (distal to it) in the arch. Following the curvature of the dental arch, it is the tooth surface that faces away from the midline (median line). With deciduous second molars and permanent third molars, it is that surface which faces posteriorly in the arch.

h. **Axial.** The axial surface is any surface of a tooth that is parallel to the long axis of the tooth (see figure 4-6). The long axis is an imaginary straight line passing through the crown and root of the tooth. The facial, lingual, mesial, and distal are all axial surfaces.

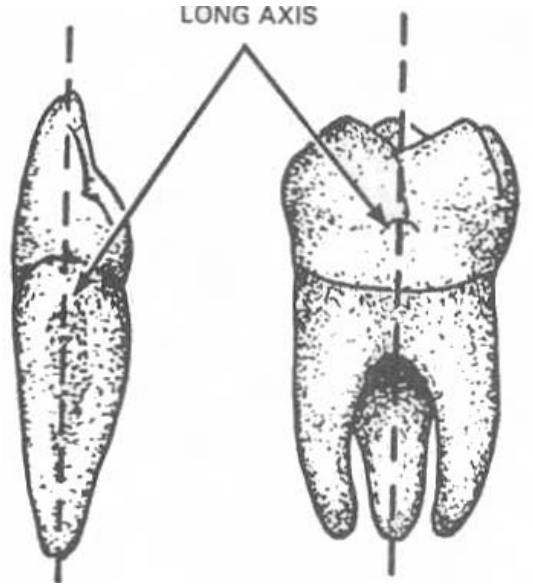

Figure 4-6. Axial surface of a tooth.

4-8. DIVISION OF TEETH

To simplify the description of the surface anatomy of teeth, the crown and roots are divided into imaginary thirds. Each axial surface of the crown is divided into both vertical and horizontal thirds. The root is divided into horizontal thirds only. See figure 4-7.

a. Each crown is divided into horizontal thirds--occlusal (or incisal), middle, and cervical (or gingival).

b. Each mesial and distal surface of the crown is divided into vertical thirds--facial, middle, and lingual.

c. Each facial and lingual surface of the crown is divided into vertical thirds--mesial, middle, and distal.

d. Each root is divided into horizontal thirds--cervical, middle, and apical.

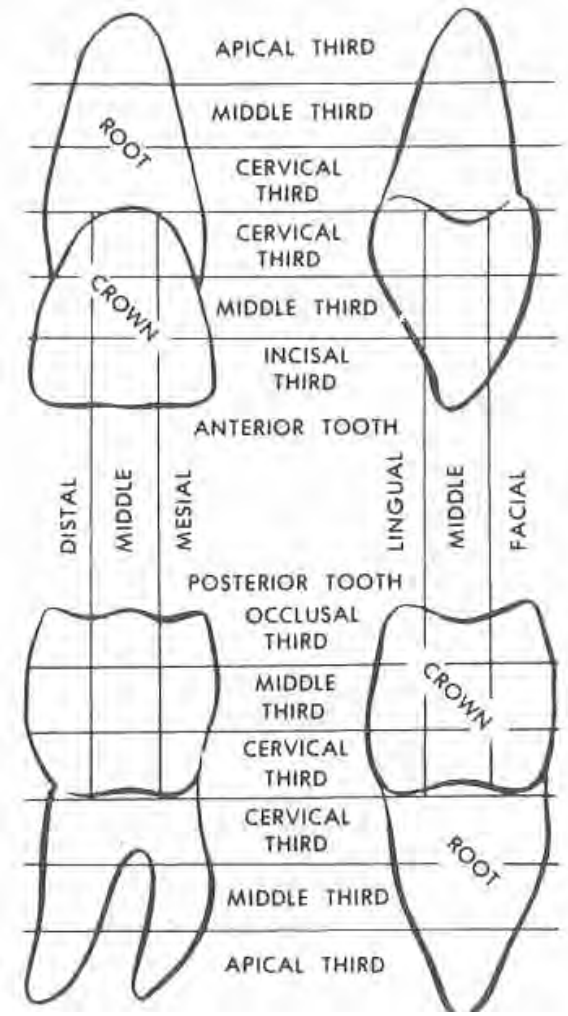

Figure 4-7. Division of teeth into thirds.

4-9. ANATOMIC TERMINOLOGY

In this paragraph, there are a series of anatomic terms that describe the location, configuration, or shape of teeth. These are terms that the dental specialist should be able to understand and use.

a. **General Terms.** See figure 4-8.

(1) Contact area (point). The contact area (point) is an area on the convex part of the mesial or distal surface of a tooth which normally contacts an adjacent tooth. The term "contact area" rather than "contact point" is preferred because the amount of contact is greater than that of a point. By means of the contact area, the teeth help to support each other when force is exerted.

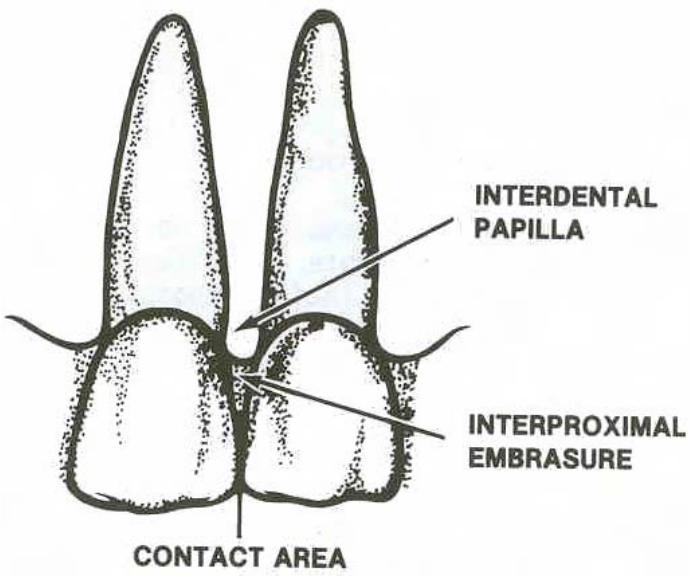

Figure 4-8. Proximal surfaces.

(2) Interproximal space. The interproximal space is a triangular space between the proximal surfaces of adjacent teeth, from the crown to the root tip. In a normal situation, part of the interproximal space is filled by the interdental (gingival) papilla.

(3) Interproximal embrasure. The part of the interproximal space not occupied by the interdental papilla is called the interproximal embrasure. It is an open space between two adjacent teeth which widens outward facially, lingually, occlusally, and gingivally from the contact area.

(4) Bifurcation. When a tooth has two roots, the root portion is said to be bifurcated. As a general rule, mandibular molars have two roots. See figure 4-1.

(5) Trifurcation. When a tooth has three roots, the root portion is said to be trifurcated. Maxillary molars have three roots.

(6) Midline. The midline (or median line) is an imaginary perpendicular line that passes between the central incisors in each arch. See figure 4-5. Mesial surfaces turn toward the midline while distal surfaces turn away from the midline.

(7) Long axis. The long axis of a tooth is an imaginary straight line passing through the crown and root of the tooth where the bulk of the tooth is most symmetrically arranged. See figure 4-6.

b. **Angles (Junctions).**

(1) Line angle. The line angle is a line formed by the junction of two surfaces. A specific line angle is often named to indicate the surfaces it joins. For example, the junction between the distal and lingual surfaces of an anterior tooth is called the distolingual line angle. The junction between the mesial and the occlusal surfaces of a posterior tooth is called the mesio-occlusal line angle. There are eight line angles per tooth.

(2) Point angle. The point angle represents the junction of three surfaces. For example, mesiolabioincisal for an anterior tooth point angle (mesial, labial, incisal surfaces) or distolinguo-occlusal for a posterior tooth point angle (distal, lingual, occlusal surfaces). There are four point angles per tooth.

c. **Rounded Elevations.**

(1) Lobe. Lobes are one of the primary anatomical divisions of a crown. All teeth develop from either four or five lobes. Each lobe was the center of calcification in the developing tooth. Lobes are usually separated by readily identifiable developmental grooves.

(2) Mamelon (scallop). A mamelon (see figure 4-9) is one of three small, rounded projections of enamel (thought to resemble a scallop shell) sometimes present on the cutting edge of a newly-erupted incisor tooth. The projections wear away soon after eruption.

Figure 4-9. Mamelons.

(3) Cingulum. The cingulum (see figure 4-10) is a prominence (bulge) of enamel found on the cervical third of the lingual surface of all anterior teeth.

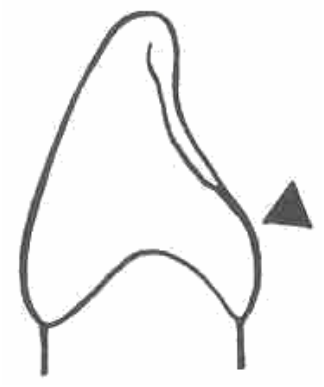

Figure 4-10. Cingulum.

(4) Cusp. A cusp is a conical (cone-shaped) or rounded elevation of enamel on the occlusal surface of bicuspids and molars and on the incisal edge of cuspids. A cuspid has a single cusp, a bicuspid has two cusps, and a molar has four cusps.

Figure 4-11. Cusp.

(5) Cusp of Carabelli. Sometimes there is a fifth cusp on the maxillary first molar. It is called the cusp of Carabelli. It is an underdeveloped, rudimentary cusp on the lingual surface of the mesiolingual cusp.

d. **Linear Elevations.**

(1) Ridge. A ridge is an elongated elevation of enamel on the crown surface of a tooth. Several different ridges can be found on a tooth. They are named for their location.

(2) Marginal ridge. Marginal ridges (see figure 4-12) are elevations of enamel which form the mesial and distal margins of the occlusal surfaces of posterior teeth (on a bicuspid or a molar). They also form the mesial and distal margins of the lingual surface of anterior teeth (on an incisor or a cuspid).

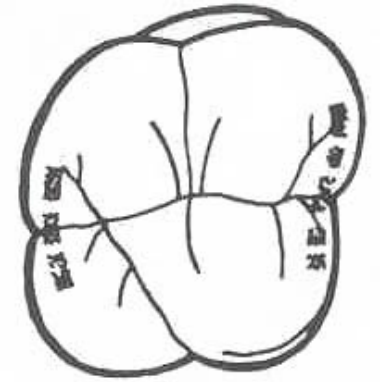

Figure 4-12. Marginal ridges.

(3) Triangular ridge. This feature is a triangular-shaped ridge of enamel. The triangular ridge (see figure 4-13) passes from the tip of a cusp to the central part of the occlusal surface of a bicuspid or molar.

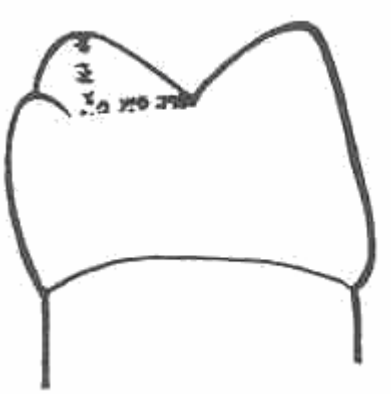

Figure 4-13. Triangular ridge.

(4) Transverse ridge. The transverse ridge is formed by the union of a facial and a lingual triangular ridge on the occlusal surface of a posterior tooth.

(5) Oblique ridge. The oblique ridge (see figure 4-14) is a transverse ridge of enamel found only on maxillary molars. It connects the mesiolingual cusp with the distofacial cusp. This ridge is important for charting and for operative dentistry, since the dentist tries to preserve this strong ridge whenever possible.

Figure 4-14. Oblique ridge.

e. **Depressions.**

(1) Fossa. A fossa (see figure 4-15) is a rounded or wedge-shaped depression on the surface of a tooth.

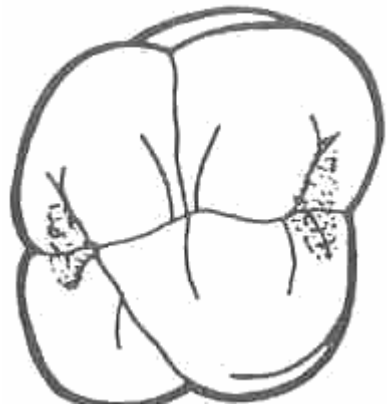

Figure 4-15. Fossa.

(2) Sulcus. A sulcus (see figure 4-16) is an elongated depression (or valley) on the surface of a tooth. It is formed by the inclines of adjacent cusps or ridges. The sulcus has a developmental groove at the junction of its inclines (at the bottom).

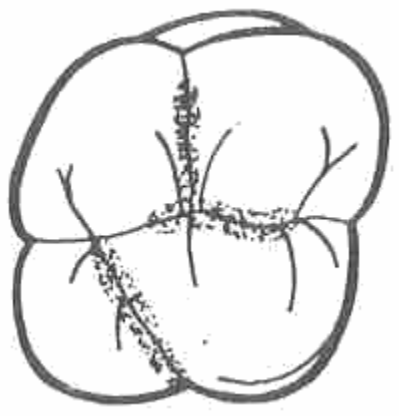

Figure 4-16. Sulcus.

(3) Groove. A groove is a linear depression on the surface of a tooth. Grooves are formed by the union of two lobes during the development of the crown. A marginal groove is a depression running perpendicular to a marginal ridge. Facial and lingual grooves are, simply, grooves on the facial and lingual surfaces of the teeth. Grooves are indicated on the standard dental chart by means of dark lines. See figure 4-4.

(4) Developmental groove. A developmental groove (see figure 4-17) is a depression in the crown of a tooth that marks the boundary between separate lobes. They are the junction lines between the inclined walls of a sulcus. These grooves appear on facial, lingual, and occlusal surfaces.

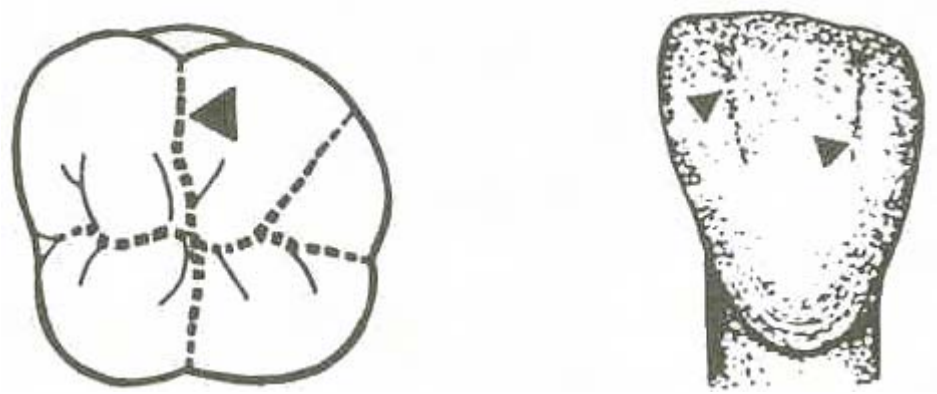

Figure 4-17. Developmental grooves.

(5) Fissure. A fissure (see figure 4-18) is a fault occurring along a developmental groove caused by incomplete or imperfect joining of the lobes.

Figure 4-18. Fissure.

(6) Pit. A pit is a small, pointed depression in the enamel of a tooth. It is usually found at the bottom of a fossa, or at the end of a developmental groove, where two or more enamel lobes are joined, or at a place where two fissures intersect. (Note that teeth with pits and fissures are hard to clean and are least likely to be protected against decay by fluoride.)

(7) Example. Figure 4-19 shows features of the occlusal surface of a maxillary first molar.

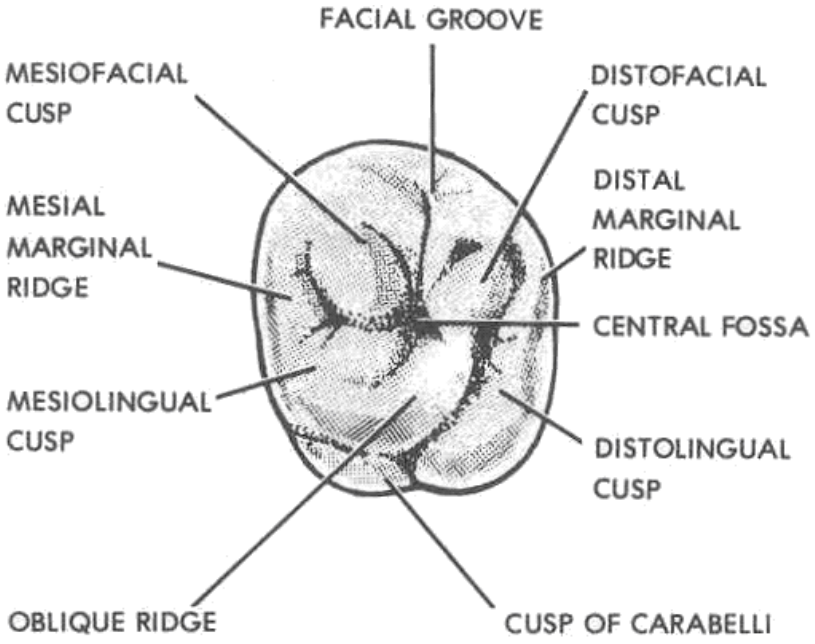

Figure 4-19. Features of the occlusal surface of a maxillary first molar.

Section II. MAXILLARY TEETH

4-10. MAXILLARY CENTRAL INCISOR

The maxillary central incisor (figure 4-20) is located adjacent to the midline (median line) on the anterior portion of the maxillary dental arch. Its mesial surface contacts the mesial surface of the maxillary central incisor of the opposite side. This tooth has the greatest mesiodistal width of all anterior teeth. Like all anterior teeth, it develops from four fused lobes. Three of these lobes making up the facial surface and the fourth forming the cingulum on the lingual surface. Newly erupted incisor teeth have three mamelons (scallops) on their incisal edges conforming to the three labial lobes; these mamelons are usually worn away within a short period of time.

a. **Facial Surface.** The facial surface is broad, resembling a thumbnail in outline. Its incisal two-thirds is relatively flat and broad while the gingival one-third is more convex. The gingival margin is convex toward the root. The surface has two shallow, longitudinal (axial) depressions, which are developmental grooves representing fusion of the three facial lobes. The distoincisal angle is more rounded than the mesioincisal angle.

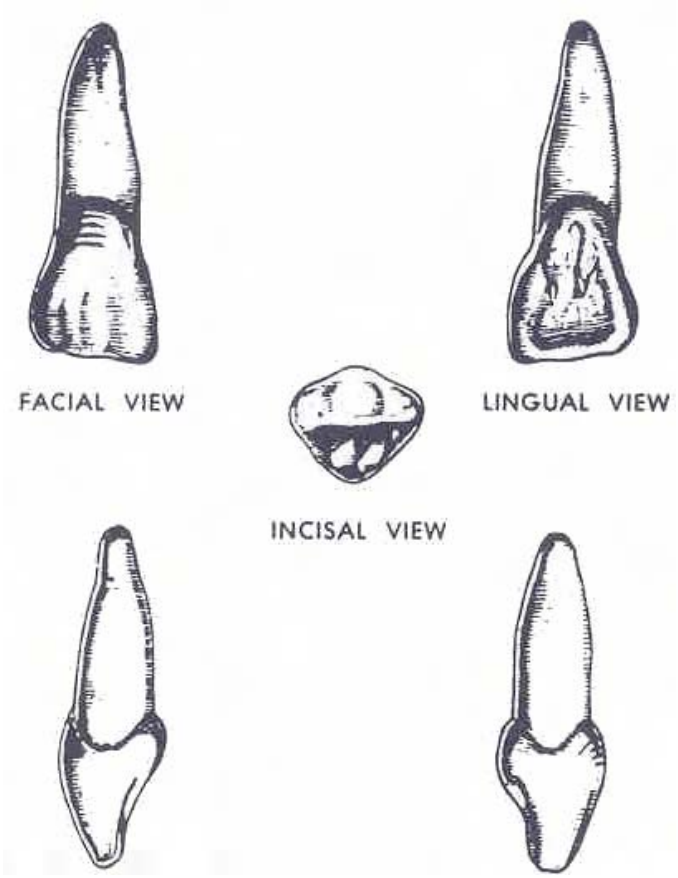

Figure 4-20. Maxillary right central incisor.

b. **Lingual Surface.** The lingual surface is scoop-like or shovel-like in appearance and is bounded by prominent mesial and distal marginal ridges. It is narrower than the facial surface because both proximal surfaces converge toward the lingual. The cingulum is located in the cervical third and is slightly distal to the midline of the crown. The incisal two-thirds is concave and the cervical one-third is convex in outline.

c. **Mesial Surface.** The mesial surface is somewhat triangular in shape with the apex of the triangle toward the incisal edge. It has a slight faciolingual convexity. The contact area is located in the incisal third.

d. **Distal Surface.** The distal surface is smaller in area but similar in outline to the mesial surface. Its contours are more convex than those of the mesial surface. The contact is located near the junction of the middle and incisal thirds.

e. **Incisal Edge.** The incisal edge is fairly straight and ends in curved mesioincisal and distoincisal angles. The distoincisal curvature is more pronounced than is the mesioincisal curvature. The incisal edge is usually worn so that it presents a distinct, narrow surface which usually slopes toward the lingual surface.

f. **Root.** The single root averages about 1 1/4 times the length of the crown. This single root tapers gradually from about its midsection to end in a rounded apex. In cross section, the root is egg-shaped with the narrow curvature toward the lingual surface.

4-11. MAXILLARY LATERAL INCISOR

The maxillary lateral incisor (figure 4-21) is smaller in size than the central incisor but has the same general appearance. It presents a generally greater convexity in its crown portion than does the central incisor. The maxillary lateral incisor can be compared with the central incisor in many ways.

a. **Facial Surface**. The facial surface is similar in appearance to the central incisor but more convex (rounded) in form. Developmental grooves are not as pronounced as in the central incisor.

b. **Lingual Surface**. The lingual surface is similar in appearance to the central incisor. The marginal ridges are relatively broader. The lingual pit is often small, deep, and irregular in shape.

c. **Mesial Surface**. The mesial surface is similar to the mesial surface of the central incisor.

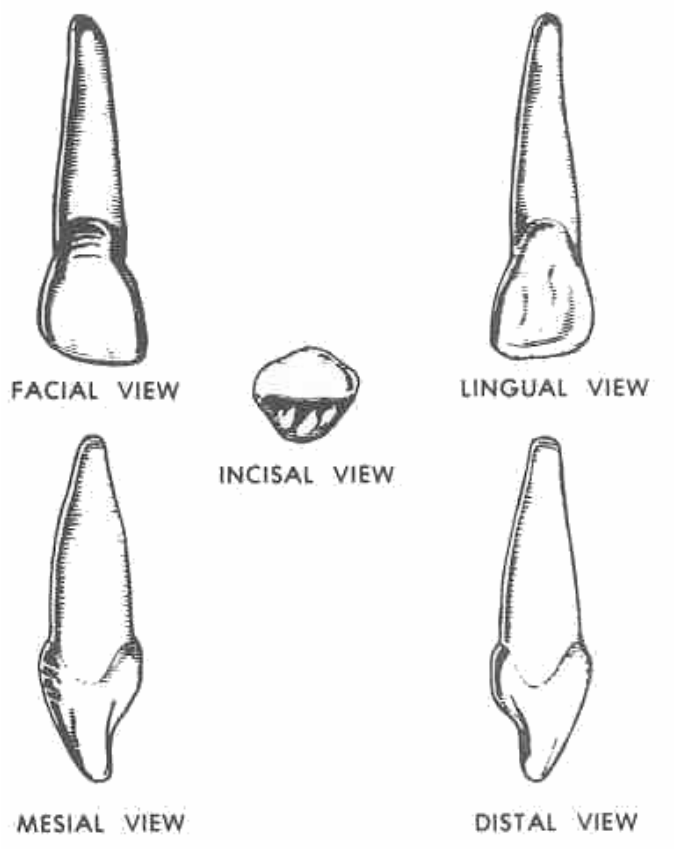

Figure 4-21. Maxillary right lateral incisor.

d. **Distal Surface.** The distal surface is convex in all directions. The distal contact area is relatively nearer the cervical or gingival margin than in the central incisor.

e. **Incisal Edge.** The incisal edge is similar to that of the central incisor. The outline of the incisal edge reflects generally the greater convexity of the lateral incisor.

f. **Root.** The root averages about 1 1/2 times the length of the crown. This single root is smaller than that of the central incisor, but has a greater relative length in comparison to the length of the crown. It is oval-shaped in cross section. Its apical one-third inclines toward the distal.

4-12. MAXILLARY CUSPID

The maxillary cuspid (figure 4-22) is the third tooth from the median line. It is the longest and the only single-cusp tooth in the arch. Located at the angle between the anterior and the posterior portions of the dental arch, it plays an important role in determining facial features of the individual and in controlling mandibular movement. It is sometimes called the "canine tooth" or "eye tooth."

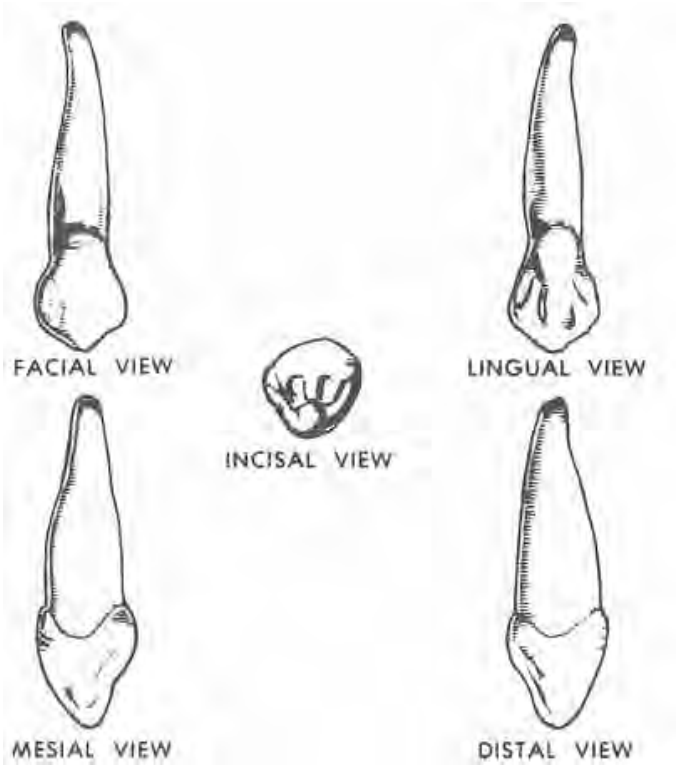

Figure 4-22. Maxillary right cuspid.

a. **Facial Surface.** The facial surface is markedly convex in all directions. The facial surface has two longitudinal (axial) grooves delineating the development lobes. The middle lobes are developed into a prominent ridge running lengthwise from the cusp area to the cervical third of this surface. The mesial cusp arm is shorter than the distal cusp arm.

b. **Lingual Surface.** The lingual surface is scoop-like or shovel-like in appearance and is bounded by prominent mesial and distal marginal ridges. It is narrower than the facial surface because both proximal surfaces converge toward the lingual. The cingulum is located in the cervical third and is slightly distal to the midline of the crown. The incisal two-thirds is concave and the cervical one-third is convex in outline.

c. **Mesial Surface.** The mesial surface is somewhat triangular in shape with the apex of the triangle toward the incisal edge. It has a slight faciolingual convexity. The contact area is located in the incisal third.

d. **Distal Surface.** The distal surface is smaller in area but similar in outline to the mesial surface. Its contours are more convex than those of the mesial surface. The contact is located near the junction of the middle and incisal thirds.

e. **Incisal Edge.** The incisal edge is fairly straight and ends in curved mesioincisal and distoincisal angles. The distoincisal curvature is more pronounced than is the mesioincisal curvature. The incisal edge is usually worn so that it presents a distinct, narrow surface which usually slopes toward the lingual surface.

f. **Root.** The single root averages about 1 1/4 times the length of the crown. This single root tapers gradually from about its midsection to end in a rounded apex. In cross section, the root is egg-shaped with the narrow curvature toward the lingual surface.

4-13. MAXILLARY FIRST BICUSPID

The maxillary first bicuspid (figure 4-23) has the largest crown of the four maxillary bicuspid teeth. It is formed from four developmental lobes--three lobes form the facial cusp and one lobe forms the lingual cusp.

a. **Facial Surface.** The facial surface resembles the facial surface of the maxillary cuspid but is not as long or as broad.

b. **Lingual Surface.** The lingual surface is oval in shape and convex in all directions. It is shorter and narrower than the facial surface.

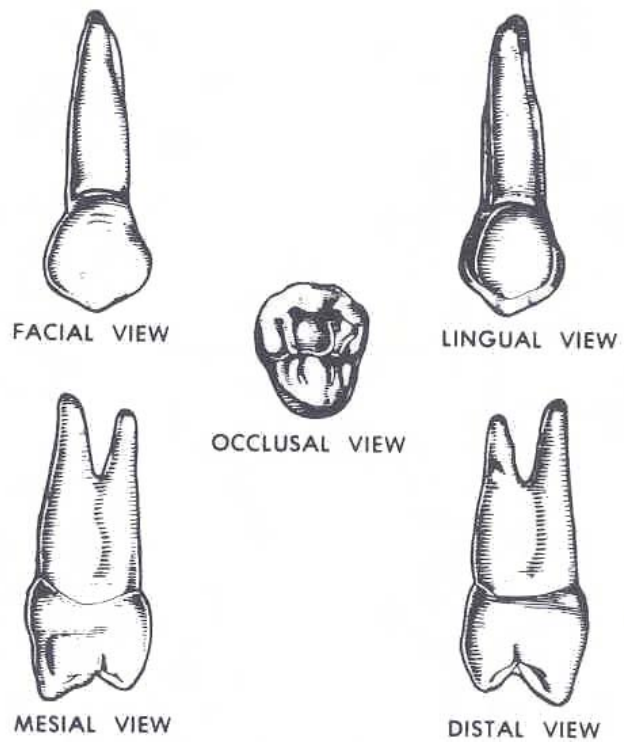

Figure 4-23. Maxillary right first bicuspid.

c. **Mesial Surface.** The mesial surface is rectangular in outline, convex in the occlusal two-thirds, and concave in its gingival (cervical) third. The contact area is located at the junction of the middle and occlusal thirds.

d. **Distal Surface.** The distal surface resembles the mesial surface but is slightly more convex.

e. **Occlusal Surface.** The occlusal surface has two cusps. The facial cusp is larger and more prominent than the lingual cusp. A central depression is bounded by the slopes of the facial and lingual cusps and by mesial and distal marginal ridges. The mesial marginal ridge is divided by a prominent groove, the mesiolingual groove. This groove extends from the occlusal surface over the marginal ridge to the mesial surface. A groove at the line of junction between the cusps ends in mesial and distal pits.

f. **Roots.** The roots are bifurcated to form two roots about halfway to two-thirds of the way from the crown to the apex

4-14. MAXILLARY SECOND BICUSPID

The maxillary second bicuspid (figure 4-24) is very similar to the first bicuspid. There are some differences. It has smaller crown dimensions than the first bicuspid. The cusps are about the same height. The marginal ridge is not divided by a prominent mesiolingual groove. The single root of this tooth is slightly bulkier than the root of the first bicuspid. The contact areas are located slightly closer to the occlusal and facial surfaces.

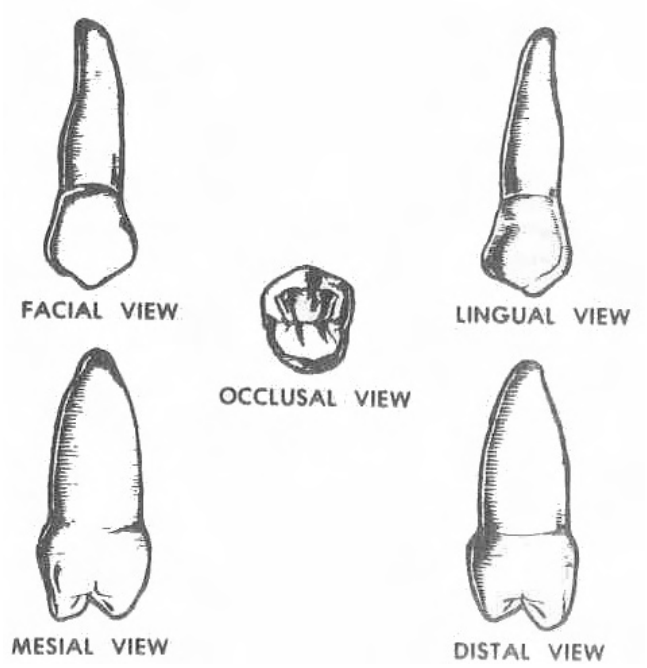

Figure 4-24. Maxillary right second bicuspid.

4-15. MAXILLARY FIRST MOLAR

The maxillary first molar (see figure 4-25) is the largest tooth in the mouth. It develops from four lobes and is often called the "six year molar" because of the age at which it erupts.

a. **Facial Surface.** The facial surface is convex in all directions. A groove (the facial groove) passes vertically from the middle of this surface, between the two facial cusps, and onto the occlusal surface. The mesiofacial cusp is higher and wider than is the distofacial cusp.

b. **Lingual Surface.** The lingual surface is more convex and smaller in area than the facial surface. The mesiolingual cusp is larger than the distolingual cusp. An oblique groove, the lingual portion of the distolingual groove, passes from the lingual surface between the two lingual cusps and onto the occlusal surface. A fifth (supplemental) cusp, which develops from the fifth lobe, is present on the mesiolingual surface. This cusp, when present, is called the cusp of Carabelli.

c. **Mesial Surface.** The mesial surface is nearly flat in all directions. The contact area is located at the junction of the middle and occlusal thirds on the facial third of this surface.

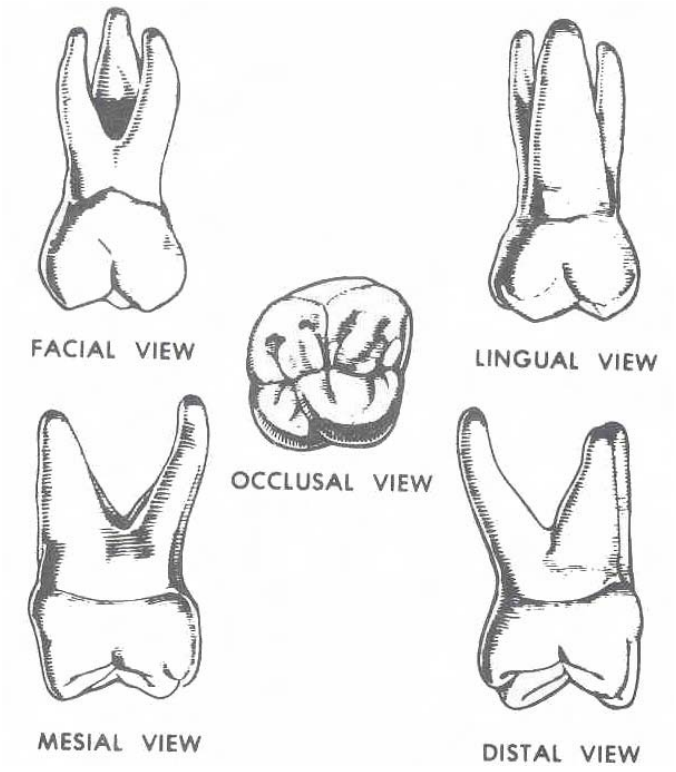

Figure 4-25. Maxillary right first molar.

d. **Distal Surface.** The distal surface resembles the mesial but it is more convex. It is shorter occlusocervically.

e. **Occlusal Surface.** The occlusal surface has four cusps. Each cusp is named according to its position on the tooth (for example, mesiofacial, mesiolingual, and mesiooccclusal). Each cusp is developed from a single developmental lobe. An oblique ridge is formed by a continuation of enamel ridges from the mesiolingual and the distofacial cusps. Three pits are formed on this surface--the mesial, the central, and the distal pits. These pits are found in corresponding fossae. A distolingual groove runs from the distal pit onto the lingual surface. A facial groove runs from the central pit, between the two facial cusps, to the facial surface.

f. **Roots.** The roots divide into three separate roots in its cervical (gingival) third. Each root is named according to its position on the tooth--mesiofacial, distofacial, and lingual. The lingual root is larger and longer than the facial roots. The mesiofacial root is larger than the distofacial root.

4-16. MAXILLARY SECOND MOLAR

The maxillary second molar (figure 4-26) is very similar to the maxillary first molar. There are some differences. It is smaller in all dimensions than the first molar. The fifth cusp is seldom present. The distolingual cusp is proportionally smaller. The mesiofacial and distofacial roots are occasionally fused.

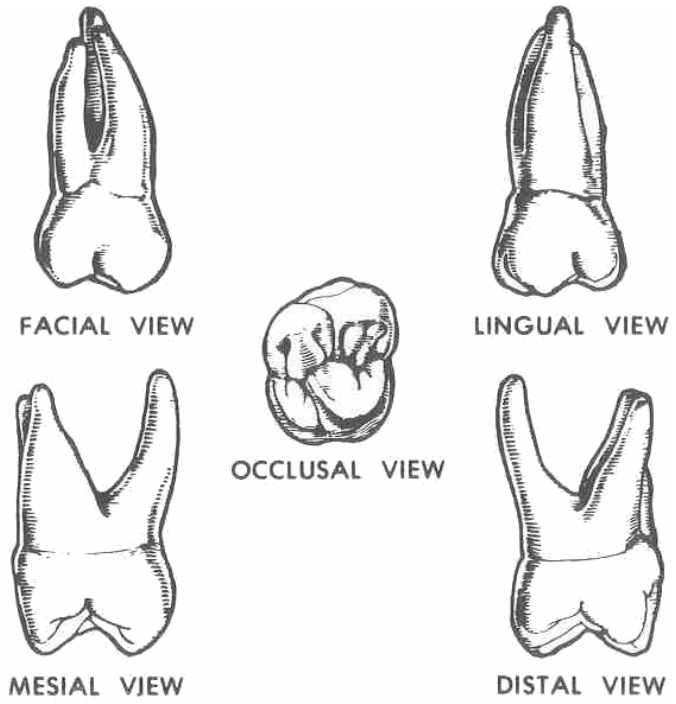

Figure 4-26. Maxillary right second molar.

4-17. MAXILLARY THIRD MOLAR

The maxillary third molar (figure 4-27) may occur in a great variety of forms. In its most common form, it resembles the maxillary second molar but is smaller in all dimensions. It is often called the wisdom tooth.

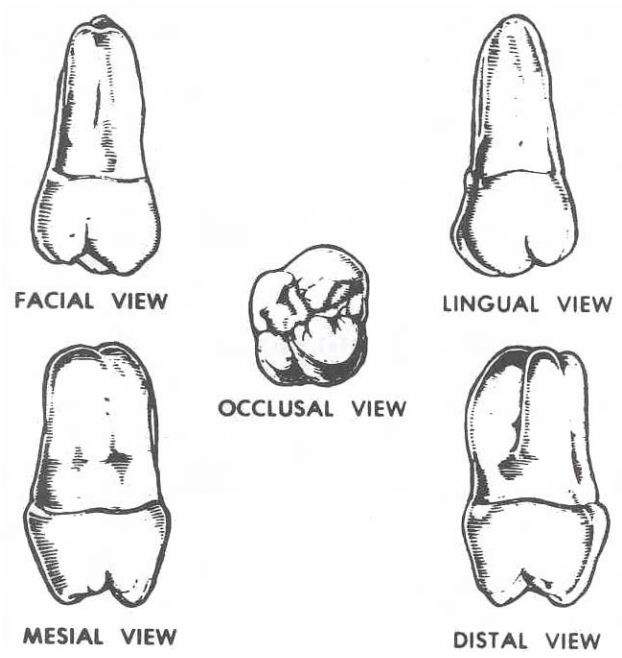

Figure 4-27. Maxillary right third molar.

Section III. MANDIBULAR TEETH

4-18. MANDIBULAR CENTRAL INCISOR

The mandibular central incisor (figure 4-28) is located adjacent to the median line in the anterior portion of the mandibular dental arch. Its mesial surface contacts the mesial surface of the central incisor of the opposite side. It is the smallest and most symmetrical of all teeth. Developmental grooves are indistinct.

a. **Facial Surface.** The facial surface is flat in the incisal two-thirds and convex in the cervical third. It is widest near the incisal edge. The incisal edge forms a straight line at nearly right angles to the long axis and forms slightly acute angles with the mesial and distal surfaces.

b. **Lingual Surface.** The lingual surface is narrower than the facial surface. The incisal two-thirds is concave and bounded by mesial and distal marginal ridges. In the cervical third, or cingulum area, it is convex.

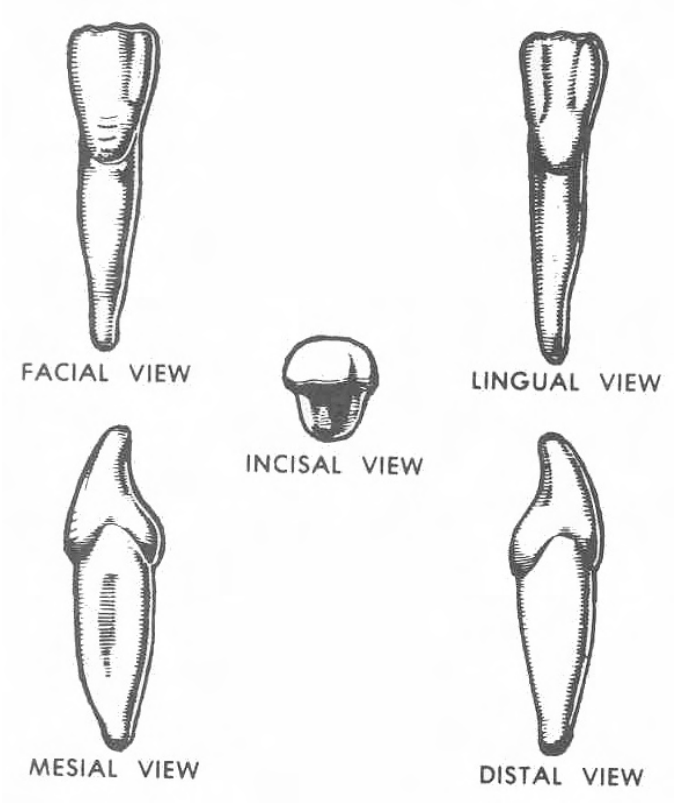

Figure 4-28. Mandibular right central incisor.

c. **Mesial Surface.** The mesial surface is triangular in shape. It is almost flat in its entire length. The contact area is located in the incisal third.

d. **Distal Surface.** The distal surface resembles the mesial surface except for being slightly more convex.

e. **Incisal Edge.** The incisal edge appears slightly curved from mesial to distal. Its thickness increases with wear.

f. **Root.** The root is narrow mesiodistally, but broad faciolingually. The apical portion may have a slight distal inclination.

4-19. MANDIBULAR LATERAL INCISOR

The mandibular lateral incisor (figure 4-29) resembles the mandibular central incisor and the maxillary lateral incisor in many respects. The mandibular lateral incisor is slightly larger in all dimensions and is less symmetrical in outline.

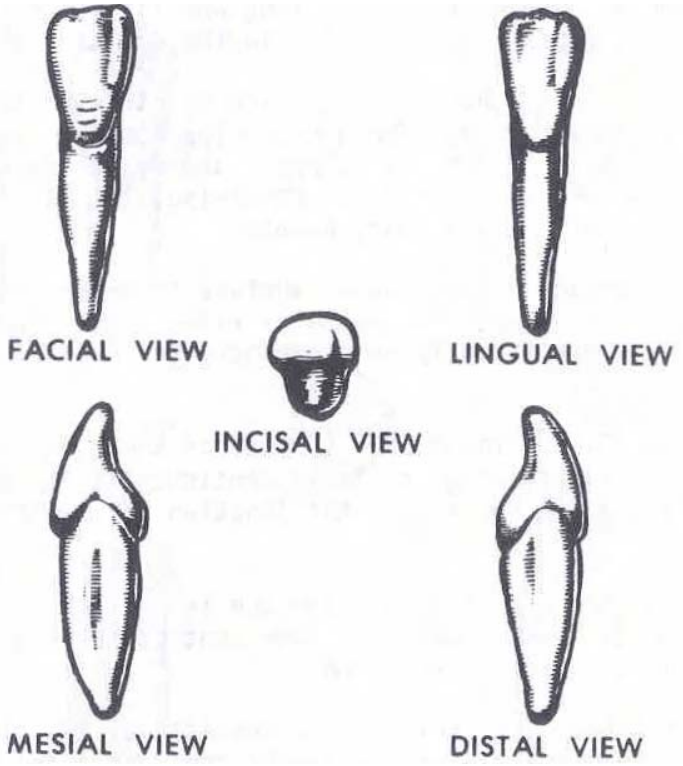

Figure 4-29. Mandibular right lateral incisor.

a. **Facial Surface.** From the facial view, the facial surface of the incisal edge slopes distally while the central incisor is straight. The mesioincisal angle is more acute. The distoincisal angle is more obtuse and rounded than those of the central incisor.

b. **Lingual Surface.** The lingual surface has marginal ridges and cingulum slightly more pronounced than those of the central incisor.

c. **Mesial and Distal Surfaces.** The mesial and distal surfaces closely resemble those of the central incisor. The contact area on the distal surface is at the junction of the incisal and middle thirds rather than in the incisal third as in the central incisor.

d. **Incisal Edge.** The incisal edge has more distal curvature than does that of the central incisor.

e. **Root.** The root is longer than that of the central incisor.

4-20. MANDIBULAR CUSPID

The mandibular cuspid (figure 4-30) resembles the maxillary cuspid in many respects. The mandibular cuspid is long and firmly anchored in the alveolar bone. It occupies a key position in the dental arch.

a. **Facial Surface.** The facial surface is narrower than the facial surface of the maxillary cuspid. The distal slope of the incisal margin is almost twice the length of the mesial slope. The mesial margin is almost parallel to the long axis of the tooth. Otherwise, the facial surface is much the same as that of the maxillary cuspid.

b. **Lingual Surface.** The lingual surface is narrower but similar in outline to the facial surface. The marginal ridges, the cingulum, and the lingual axial ridge are not nearly so pronounced as they are on the maxillary cuspid.

c. **Mesial Surface.** The mesial surface of the crown is triangular in outline. It is flat, forming an almost continuous flat surface with the root. The contact area is located at the junction of the incisal and middle thirds.

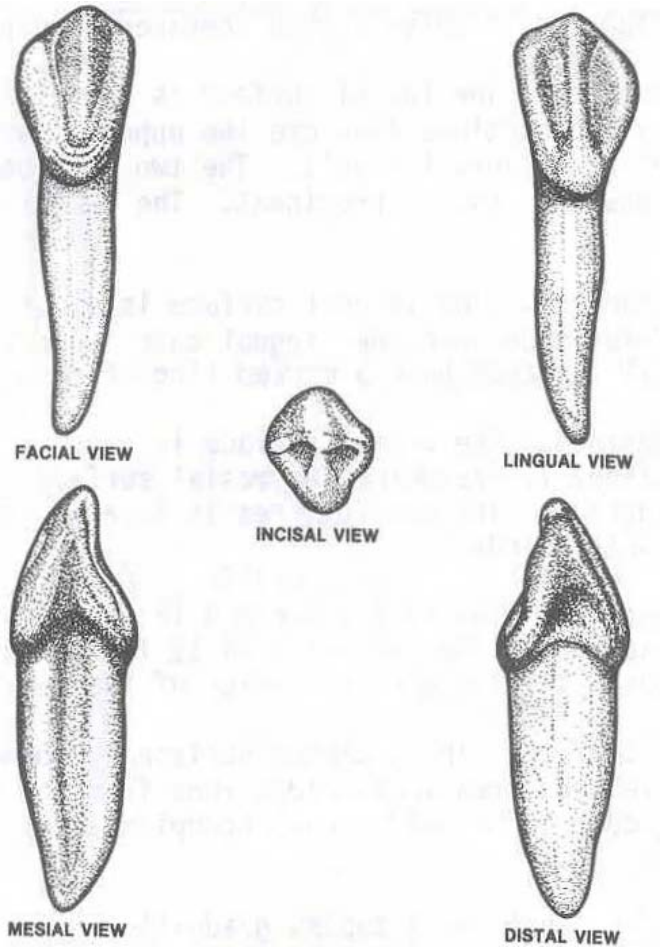

Figure 4-30. Mandibular right cuspid.

d. **Distal Surface.** The distal surface is smaller in area and much more convex than is the mesial surface. The contact area is located at the junction of the incisal and middle thirds.

e. **Incisal Edge.** The incisal edge consists of two sloping narrow surfaces forming a curved angle at the tip of the cusp. The distal slope is about twice the length of the mesial slope. The tip of the cusp is located at the junction of the mesial third and the middle third of the crown.

f. **Root.** The root is flattened mesiodistally and the apical portion is usually inclined distally. It is shorter than the root of the maxillary cuspid.

4-21. MANDIBULAR FIRST BICUSPID

The mandibular first bicuspid (figure 4-31) is the smallest tooth in the bicuspid group. It possesses characteristics of all bicuspids but it differs greatly in form, particularly when compared to upper bicuspids.

a. **Facial Surface.** The facial surface is symmetrical in outline and more convex in all directions than are the upper bicuspids, giving the crown a form resembling an inverted bell. The two developmental grooves and the facial axial ridge are usually prominent. The facial cusp is long and sharp.

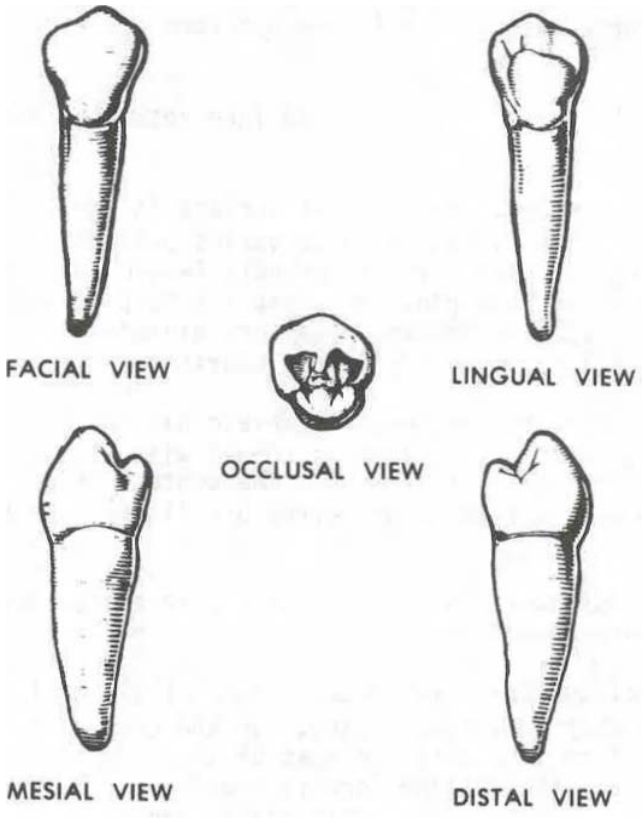

Figure 4-31. Mandibular right first bicuspid.

b. **Lingual Surface.** The lingual surface is about half the size of the facial cusp. This is because the lingual cusp is very short and because the mesial and distal surfaces have a marked lingual convergence.

c. **Mesial Surface.** The mesial surface is convex in all directions. In outline, it resembles the mesial surface of a lower cuspid with an enlarged cingulum. The contact area is located at the junction of the middle and occlusal thirds.

d. **Distal Surface.** The distal surface is more convex faciolingually than is the mesial surface. The contact area is located at the junction of the middle and occlusal thirds near the center of the surface.

e. **Occlusal Surface.** The occlusal surface is round to oval in outline. A well-developed transverse ridge runs from the tip of the facial cusp to the lingual cusp. The facial cusp occupies about four-fifths of the occlusal surface.

f. **Roots.** The single root tapers gradually toward the apex. Near the crown, the root is narrower lingually than it is facially.

4-22. MANDIBULAR SECOND BICUSPID

The mandibular second bicuspid (figure 4-32) is slightly larger, stockier, and less rounded than the mandibular first bicuspid. It is, however, more rounded or ovoid (egg-shaped) than the maxillary bicuspids and may have two or three cusps. The three-cusp form has two lingual cusps and one facial cusp.

a. **Facial Surface.** The facial surface resembles the facial surface of the first bicuspid.

b. **Lingual Surface.** The lingual surface is similar in outline to the facial surface. The lingual surface varies somewhat with the number and arrangement of lingual cusps. It is markedly larger than the lingual surface of the mandibular first bicuspid. The cusp (or cusps) is also much larger. Where two lingual cusps are present, they are divided by a lingual groove passing from the occlusal onto the lingual surface.

c. **Mesial Surface.** The mesial surface has the form of a lingually inclined parallelogram. The surface is convex with a shallow concavity sometimes present in the cervical area. The contact area is located at the junction of the middle and occlusal thirds and lingual to the midline of the tooth.

d. **Distal Surface.** The distal surface resembles the mesial surface, but is slightly more convex.

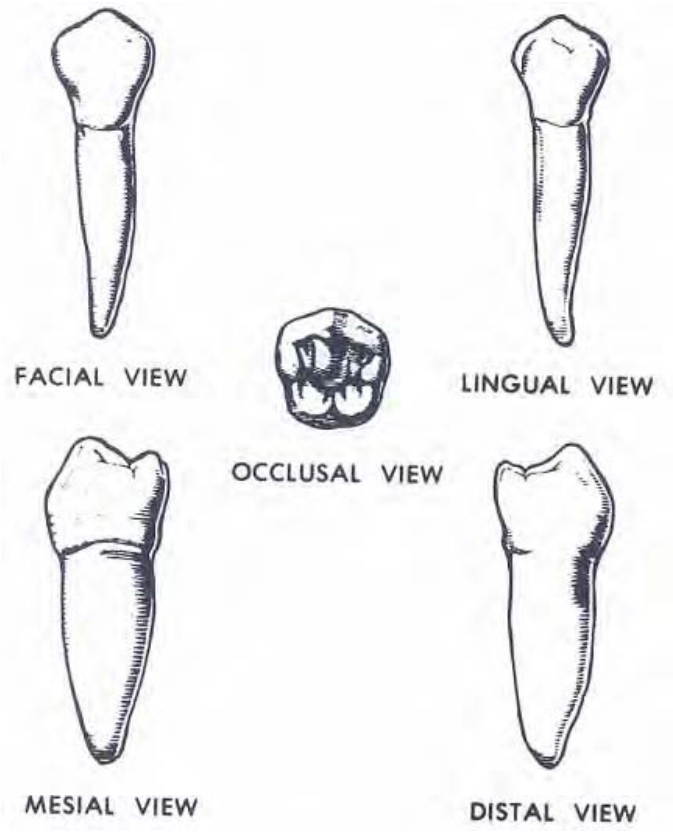

Figure 4-32. Mandibular right second bicuspid.

e. **Occlusal Surface.** The outline form of the occlusal surface varies with the number of lingual cusps. In the case of a single lingual cusp, the outline form is similar to that of the first bicuspid. In the case of two lingual cusps, the outline form is broader and more rectangular toward the lingual. In the case of a two-cusp tooth, the occlusal surface resembles that of a maxillary bicuspid. In the case of a three-cusp tooth, a prominent lingual groove passes from the occlusal surface, between the lingual cusps, onto the lingual surface.

f. **Root.** The root is longer and larger than the root of the first bicuspid. A cross section at the cervix is ovoid in form. Most of the taper is confined to the apical third.

4-23. MANDIBULAR FIRST MOLAR

The mandibular first molar is the largest tooth in the mandible (see figure 4-33). It has five functional cusps, each of which develops from a separate lobe. The maxillary and mandibular first molars are often called "six-year" molars because of the age at which they erupt. Eruption of the mandibular teeth usually precedes that of the maxillary teeth by several months. This tooth plays a vital role in the establishment and maintenance of occlusion. It is called "the key to occlusion."

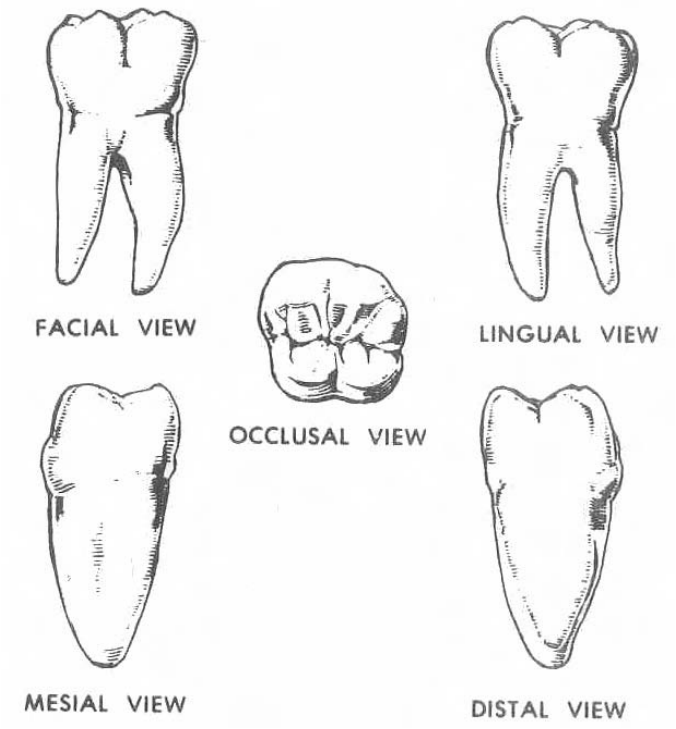

Figure 4-33. Mandibular right first molar.

a. **Facial Surface.** The facial surface is convex in all directions. A facial groove and a distofacial groove are continuations of grooves from the occlusal surface which end on the facial surface. Its occlusal margin is made up of six slopes (two slopes for each of three facial cusps).

b. **Lingual Surface.** The lingual surface is smaller than the facial surface. Its occlusal margin is formed by the four slopes of the two lingual cusps. A distinct lingual groove is continuous from the occlusal surface ending in the middle third of this surface.

c. **Mesial Surface.** The mesial surface has the form of a lingually inclined parallelogram. It is flat in appearance with its greatest convexity in the occlusal third. The contact area is located at the junction of the middle and occlusal thirds.

d. **Distal Surface.** The distal surface is convex in all directions. It is smaller in area than the mesial surface. The contact area is located at the junction of the middle and occlusal thirds, slightly more to the lingual than is the contact area of the mesial surface.

e. **Occlusal Surface.** The occlusal surface is characterized by the presence of a fifth cusp called the distal cusp. This cusp is smaller than the other cusps. It forms part of the masticating surface of the tooth. The presence of this cusp is accompanied by the presence of additional developmental grooves. Three grooves--facial, distofacial, and lingual--have been mentioned in descriptions of the facial and lingual surfaces. Other grooves are a central groove and mesial and distal developmental grooves. The mesial developmental groove runs from the central fossa over the mesial marginal ridge. The distal developmental groove runs from the central fossa over the distal marginal ridge.

f. **Roots.** The roots are divided into a mesial and a distal root. The bifurcation is located closer to the crown than the bifurcation of any of the other teeth. Both roots are wide faciolingually and narrow mesiodistally. The mesial root is larger than the distal root. The mesial root commonly has a distal inclination in its apical portion. The distal root may have a similar curvature but usually is straight.

4-24. MANDIBULAR SECOND MOLAR

The mandibular second molar (figure 4-34) is smaller than the mandibular first molar but is similar in general appearance. Cusps are usually four in number, but occasionally there are five. They are arranged similarly to those of the mandibular first molar. Because of the age at which they erupt, they are sometimes called the "twelve-year molar."

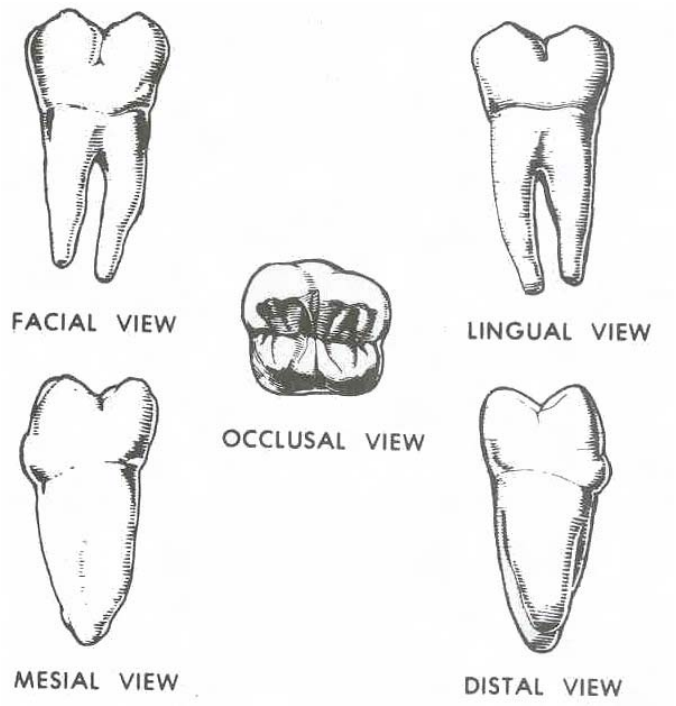

Figure 4-34. Mandibular right second molar.

a. **Facial Surface.** The facial surface is rectangular in shape and convex in form. Its occlusal margin consists of the slopes of two similarly shaped cusps separated by a facial groove. The facial groove is a continuation of a groove from the occlusal surface which ends at the middle of the facial surface. The mesial cusp is slightly larger than the distal cusp.

b. **Lingual Surface.** The lingual surface resembles the lingual surface of the mandibular first molar. The lingual groove, which is a continuation of the lingual groove of the occlusal surface, ends at the middle of this surface.

c. **Mesial Surface.** The mesial surface is similar in outline to the mesial surface of the mandibular first molar but is more convex in all directions. The contact area is located in the middle of the occlusal third.

d. **Distal Surface.** The distal surface is similar to the mesial surface but is smaller in area and more convex. The contact area is located in the middle of the occlusal third.

e. **Roots.** The two roots of the mandibular second molar resemble those of the mandibular first molar but are less divergent. The two roots present a distal inclination.

4-25. MANDIBULAR THIRD MOLAR

The mandibular third molar (figure 4-35) is commonly known as the "wisdom tooth." It may appear in any of a wide range of forms, sizes, and shapes. Typically, it resembles either the first or second mandibular molar (more often the latter). It is smaller in its overall size. Abnormalities of eruption and occlusion of third molars commonly occur.

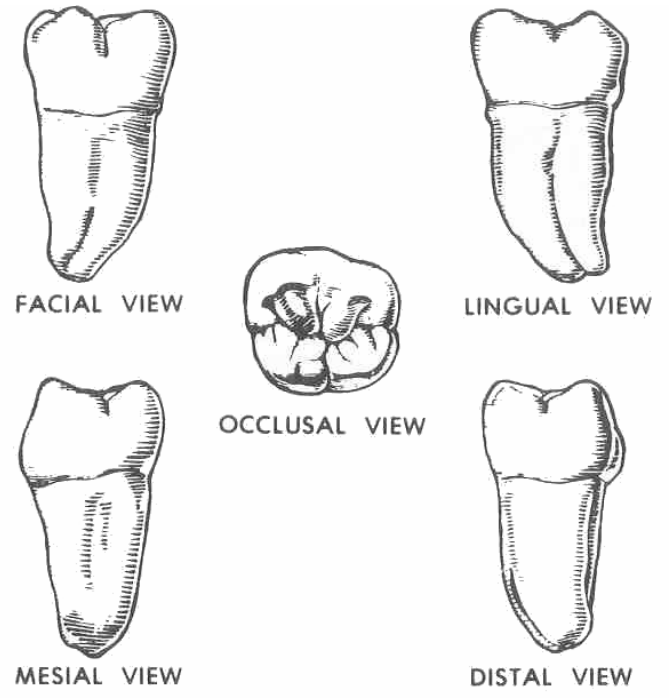

Figure 4-35. Mandibular right third molar.

Continue with Exercises

EXERCISES, LESSON 4

INSTRUCTIONS: Answer the following exercises by marking the lettered response that best answers the question, or by completing the incomplete statement, or by writing the answer in the space provided at the end of the question.

After you have completed all the exercises, turn to "Solutions to Exercises" at the end of the lesson, and check your answers. For each exercise answered incorrectly, reread the material referenced after the answer.

1. How many teeth are present in the normal permanent dentition?

   a. 20.

   b. 24.

   c. 32.

   d. 36.

2. The _____ teeth are designed for the purpose of cutting or tearing food.

   a. Anterior teeth.

   b. Posterior teeth.

3. The vertical overlap of the teeth is called the:

   a. Overjet.

   b. Overbite.

   c. Overset.

4. Which molars have three roots instead of two?

   a. Maxillary.

   b. Mandibular.

5. Which teeth have more cusps?

   a. Incisors.

   b. Cuspids.

   c. Bicuspids.

   d. Molars.

6. Complete the following statements related to deciduous teeth.

   a. Deciduous teeth are also called _____ or _____ teeth.

   b. There are ____ deciduous teeth. There are ___ deciduous teeth in each jaw.

   c. During the process of permanent tooth formation, the roots of the temporary teeth undergo _____.

7. During what period do children usually lose their deciduous teeth?

   a. 5-10 years.

   b. 6-12 years.

   c. 7-14 years.

   d. 8-16 years.

8. Normally, where are the permanent teeth during the period of deciduous dentition?

   a. They have not formed.

   b. They are completely formed under the deciduous teeth.

   c. They are in the process of formation within the jaw.

9. Which permanent teeth replace the deciduous second molars?

    a. Second molars.

    b. First bicuspids.

    c. First molars.

    d. Cuspids.

    e. Second bicuspids.

10. Why are permanent first molars lost early in life more often than other permanent teeth?

    a. They are more readily affected by dietary deficiencies than other teeth.

    b. Their structure is more fragile and thus more susceptible to decay.

    c. They are especially vulnerable because of their position in the jaw.

    d. They are often overlooked or mistaken for temporary teeth and neglected.

11. The maxillary right first bicuspid is tooth number:

    a. 21.

    b. 12.

    c. 20.

    d. 28.

    e. 5.

12. The mandibular left lateral incisor is tooth number:

    a. 10.

    b. 23.

    c. 7.

    d. 26.

    e. 9.

13. The maxillary left first molar is tooth number:

    a. 3.

    b. 28.

    c. 14.

    d. 19.

    e. 30.

14. The mandibular right cuspid is tooth number:

    a. 27.

    b. 11.

    c. 6.

    d. 22.

    e. 28.

15. Match the authorized number of the tooth in Column I and the name of the maxillary tooth in Column II.. Write your answer in the space provided.

	COLUMN I	COLUMN II
____	(1) number 12.	a. Maxillary right first molar.
____	(2) nu	b. Maxillary right second bicuspid.
____	(3) num	c. Maxillary right cuspid.
____	(4) num	d. Maxillary right central incisor.
____	(5) num	e. Maxillary left lateral incisor.
____	(6) num	f. Maxillary left cuspid.
____	(7) numb	g. Maxillary left first bicuspid.
____	(8) numb	h. Maxillary left second molar.

16. Match the authorized number of the tooth in Column I and the name of the mandibular tooth in Column II.. Write your answer in the space provided.

	COLUMN I	COLUMN II
____	(1) number 22.	a. Mandibular left second molar.
____	(2) number 24.	b. Mandibular left second bicuspid.
____	(3) number 30.	c. Mandibular left cuspid.
____	(4) number 32.	d. Mandibular left central incisor.
____	(5) number 18.	e. Mandibular right lateral incisor.
____	(6) number 20.	f. Mandibular right first bicuspid.
____	(7) number 26.	g. Mandibular right first molar.
____	(8) number 28.	h. Mandibular right third molar.

17. Match the term in Column II to the appropriate description of the surfaces of the teeth in Column I. Write your answer in the space provided.

	COLUMN I	COLUMN II
____	(1) The broad chewing surface on posterior teeth.	a. Lingual.
____	(2) The narrow cutting edge on anterior teeth.	b. Facial.
____	(3) The tooth surfaces that face each other from the crown to the root tip.	c. Occlusal
____	(4) Faces toward the tongue.	d. Incisal.
____	(5) Faces toward the cheek or lips.	e. Proximal.
____	(6) The anterior surface of the tooth.	f. Mesial.
____	(7) The posterior surface of the tooth.	g. Distal.

18. The surface that contacts the central incisor of the opposite side of the dental arch is the _____ surface.

19. What is the facial surface of posterior teeth sometimes called?

    a. Labial.

    b. Lingual.

    c. Distal.

    d. Buccal.

20. All of the following tooth surfaces are axial surfaces EXCEPT the _____ surface.

    a. Facial.

    b. Lingual.

    c. Mesial.

    d. Distal.

    e. Occlusal.

21. Each crown is divided into horizontal thirds. Select the appropriate terminology for posterior teeth.

    a. Facial, middle, and lingual.

    b. Occlusal, middle, and cervical.

    c. Mesial, middle, and distal.

    d. Cervical, middle, and apical.

    e. Incisal, middle, and gingival.

22. In the imaginary division of teeth for descriptive purposes, the apical third of a mandibular tooth lies in the:

    a. Upper third of the crown.

    b. Upper third of the root.

    c. Middle third of the crown.

    d. Lower third of the root.

23. The triangular space between the proximal surfaces of adjacent teeth, from the crown to the root tip, is termed the:

    a. Interproximal space.

    b. Contact area.

    c. Interproximal embrasure.

    d. Point angle.

24. The term distolinguo-occlusal refers to a:

    a. Line angle.

    b. Point angle.

25. Match the description of rounded elevations on the crown in Column I to the term in Column II. Write your answer in the space provided.

	COLUMN I	COLUMN II
____	(1) A prominence of enamel on the cervical third of the lingual surface of all anterior teeth.	a. Lobe.
		b. Mamelon.
____	(2) A conical elevation of enamel on the occlusal surface of molars and bicuspids.	c. Cingulum.
____	(3) An underdeveloped fifth cusp on the maxillary first molar.	d. Cusp.
____	(4) One of the primary anatomical divisions of a crown.	e. Cusp of Carabelli.
____	(5) One of three small, rounded projections of enamel on the cutting edge of a newly-erupted incisor tooth.	

26. Which ridge is found only on maxillary molars?

    a. Marginal ridge.

    b. Triangular ridge.

    c. Transverse ridge.

    d. Oblique ridge.

27. Match the tooth ridge in Column I to the type of tooth in which this feature occurs in Column II. Items in Column II can be used more than once. Items in Column I may have more than one answer. Write your answer in the space provided.

	COLUMN I	COLUMN II
____	(1) Marginal ridge.	a. Incisor or cuspid.
____	(2) Triangular ridge.	b. Bicuspid or molar.
____	(3) Transverse ridge.	c. Molar.
____	(4) Oblique ridge.	

28. Complete the following statements related to grooves.

    a. A groove is a linear _____ on the surface of a tooth formed by the union of two _____ during the development of the crown.

    b. A _____ _____ is a depression running perpendicular to a marginal ridge.

    c. A _____ _____ is the depression in the crown of a tooth that marks the boundary between separate lobes.

29. Match the description in Column I to the term in Column II.

COLUMN I		COLUMN II
____	(1) A fault occurring along a developmental groove.	a. Fossa.
____	(2) A small, pointed depression in a fossa or in a developmental groove.	b. Sulcus.
____	(3) A rounded or wedge-shaped depression on the surface of a tooth.	c. Fissure.
____	(4) An elongated depression on the surface of a tooth.	d. Pit.

30. Which of the following has a developmental groove at the junction of its inclines?

a. Pit.

b. Fossa.

c. Sulcus.

d. Fissure.

e. Marginal groove.

31. Complete the following statements related to the occlusal surface of the maxillary first molar.

a. How many cusps are identified in figure 4-19? _____

b. How many grooves are in figure 4-19? _____

32. Select the incisor that has a mesial surface that is somewhat triangular in shape and that has a root (in cross section) that is ovoid (egg-shaped)?

    a. Maxillary central incisor.

    b. Mandibular central incisor.

    c. Maxillary lateral incisor.

    d. Mandibular lateral incisor.

33. Which of the following teeth is the longest and the only single-cusp tooth in the arch?

    a. Mandibular lateral incisor.

    b. Maxillary central incisor.

    c. Mandibular cuspid.

    d. Mandibular second bicuspid.

    e. Maxillary cuspid.

34. Select the incisor that has a distal surface that is convex in all directions and that has a root (in cross section) that is oval-shaped?

    a. Mandibular lateral incisor.

    b. Maxillary central incisor.

    c. Maxillary lateral incisor.

    d. Mandibular central incisor.

35. Which of the following teeth, on the incisal edge, has a distal slope that is twice the length of the mesial slope?

    a. Mandibular lateral incisor.

    b. Maxillary cuspid.

    c. Maxillary lateral incisor.

    d. Mandibular cuspid.

    e. Mandibular central incisor.

36. Select the incisor that resembles the mandibular central incisor but has slightly more pronounced marginal ridges.

    a. Maxillary central incisor.

    b. Mandibular lateral incisor.

    c. Maxillary lateral incisor.

37. Select the smallest and most symmetrical of all teeth. The root is narrow mesiodistally but broad faciolingually.

    a. Maxillary lateral incisor.

    b. Mandibular lateral incisor.

    c. Maxillary central incisor.

    d. Mandibular cuspid.

    e. Mandibular central incisor.

38. Which is the smallest tooth in the bicuspid group?

    a. Mandibular first bicuspid.

    b. Maxillary first bicuspid.

    c. Mandibular second bicuspid.

    d. Maxillary second bicuspid.

39. Which of the bicuspids has the largest crown?

    a. Mandibular second bicuspid.

    b. Maxillary second bicuspid.

    c. Mandibular first bicuspid.

    d. Maxillary first bicuspid.

40. Select the bicuspid that is more ovoid than others, stockier than others, and may have either two or three cusps.

    a. Maxillary second bicuspid.

    b. Mandibular second bicuspid.

    c. Maxillary first bicuspid.

    d. Mandibular first bicuspid.

41. Select the tooth that appears in a wide range of forms, sizes, and shapes.

    a. Maxillary cuspid.

    b. Mandibular cuspid.

    c. Mandibular third molar.

    d. Maxillary second bicuspid.

    e. Mandibular second bicuspid.

42. Which tooth has a well-developed transverse ridge on the occlusal surface?

    a. Mandibular first bicuspid.

    b. Mandibular second bicuspid.

    c. Mandibular first molar.

    d. Maxillary first bicuspid.

    e. Maxillary first molar.

43. Select the tooth with cusps that are about the same height. The marginal ridge is not divided by a prominent mesiolingual groove.

    a. Maxillary first bicuspid.

    b. Mandibular first bicuspid.

    c. Mand bular second bicuspid.

    d. Mandibular first molar.

    e. Maxillary second bicuspid.

44. Select the tooth with a facial surface convex in all directions, a mesial surface nearly flat in all directions, and with mesiodistal and distofacial roots occasionally fused.

    a. Maxillary first molar.

    b. Maxillary second molar.

    c. Mandibular first molar.

    d. Mandibular second molar.

    e. Mandibular second bicuspid.

45. Select the molar with facial and lingual grooves. Its facial surface is rectangular in shape and convex in form, and its two roots present a distal inclination.

    a. Maxillary third molar.

    b. Maxillary second molar.

    c. Maxillary first molar.

    d. Mandibular second molar.

    e. Mandibular first molar.

46. Select the tooth with an oblique ridge and an oblique groove. It also has three pits in three distinct fossae -- mesial, central, and distal.

    a. Mandibular first molar.

    b. Maxillary first bicuspid.

    c. Maxillary first molar.

    d. Mandibular first bicuspid.

    e. Mandibular second molar.

47. Select the molar with a distal cusp (a fifth cusp) on the occlusal surface. It has developmental grooves not found on other molars.

    a. Maxillary third molar.

    b. Maxillary second molar.

    c. Maxillary first molar.

    d. Mandibular second molar.

    e. Mandibular first molar.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 4

1. c (para 4-1)

2. a (para 4-1)

3. b (para 4-2a)

4. a (para 4-2a)

5. d (para 4-2b(2)(b)

6. a. baby or milk (para 4-3a)
   b. 20; 10 (para 4-3b)
   c. resorption (para 4-3c)

7. b (para 4-3c)

8. c (para 4-3c)

9. e (para 4-4a(5); figure 4-3)

10. d (para 4-4b)

11. e (para 4-6; figure 4-4)

12. b (para 4-6; figure 4-4)

13. c (para 4-6; figure 4-4)

14. a (para 4-6; figure 4-4)

15. (1) g
    (2) h
    (3) c
    (4) d
    (5) a
    (6) b
    (7) e
    (8) f (para 4-6; figure 4-4)

16. (1) c
(2) d
(3) g
(4) h
(5) a
(6) b
(7) e
(8) f (para 4-6; figure 4-4)

17. (1) c (para 4-7c)
(2) d (para 4-7d)
(3) e (para 4-7e)
(4) a (para 4-7a)
(5) b (para 4-7b)
(6) f (para 4-7f)
(7) g (para 4-7g)

18. mesial (para 4-7f)

19. d (para 4-7b)

20. e (para 4-7h)

21. b (para 4-8a)

22. d (para 4-8d; figure 4-7)

23. a (para 4-9a(2))

24. b (para 4-9b(2)

25. (1) c
(2) d
(3) e
(4) a
(5) b (para 4-9c)

26. d (para 4-9d(5))

27. (1) a, b
(2) b
(3) b
(4) c (para 4-9d)

28. a. depression; lobes
    b. marginal groove
    c. developmental groove (para 4-9e(3),(4))

29. (1) c
    (2) d
    (3) a
    (4) b (para 4-9e)

30. c (para 4-9e(2)

31. a. 5
    b. 9 (figure 4-19)

32. a (para 4-10)

33. e (para 4-12)

34. c (para 4-11)

35. d (para 4-20)

36. b (para 4-19)

37. e (para 4-18)

38. a (para 4-21)

39. d (para 4-13)

40. b (para 4-22)

41. c (para 4-25)

42. a (para 4-21)

43. e (para 4-14)

44. b (para 4-16)

45. d (para 4-24)

46. c (para 4-15)

47. e (para 4-23)

End of Lesson 4